The FOUNDRY

Volume 49
Number 5

Published
Semimonthly

CLEVELAND, OHIO, MARCH 1, 1921

# Equips for Malleable Jobbing Work

## Experience in Former Operations Utilized in Designing and Equipping New Shop — Two and One-Half Pounds of Castings Annealed with One Pound of Coal

BY H. E. DILLER

GREAT cities which have grown into a size far vaster than had been dreamed of when the first settlement was made must suffer for lack of foresight of their founders and early builders. Few have the opportunity to rebuild like Baltimore or San Francisco after great conflagrations; but those that do, usually present a notably changed aspect. The manufacturer who builds a large plant is in much the same predicament as the city which finds it difficult to modify its plan or arrangement. Having built a plant it is almost impossible to make radical changes without practically tearing down a large portion of it and rebuilding it. Few companies have the funds for such an undertaking and unless the plans of their shops are extremely bad, go ahead with what has been instituted without a thorough knowledge of the future requirements.

The new shop of the Temple Malleable Iron & Steel Co., Temple, Pa. is of interest, because after the first plant was destroyed by fire the company had an opportunity to profit by any mistakes which might have been made in designing the first foundry; to take advantage of the latest improvements in equipment, and to make any innovations which might have suggested themselves through the operation of the first foundry. Naturally considerations such as the class and amount of work done by the company as well as labor conditions influenced the selection of labor saving devices.

It was necessary to erect the new plant as quickly as possible and to begin production. Frank D. Chase,

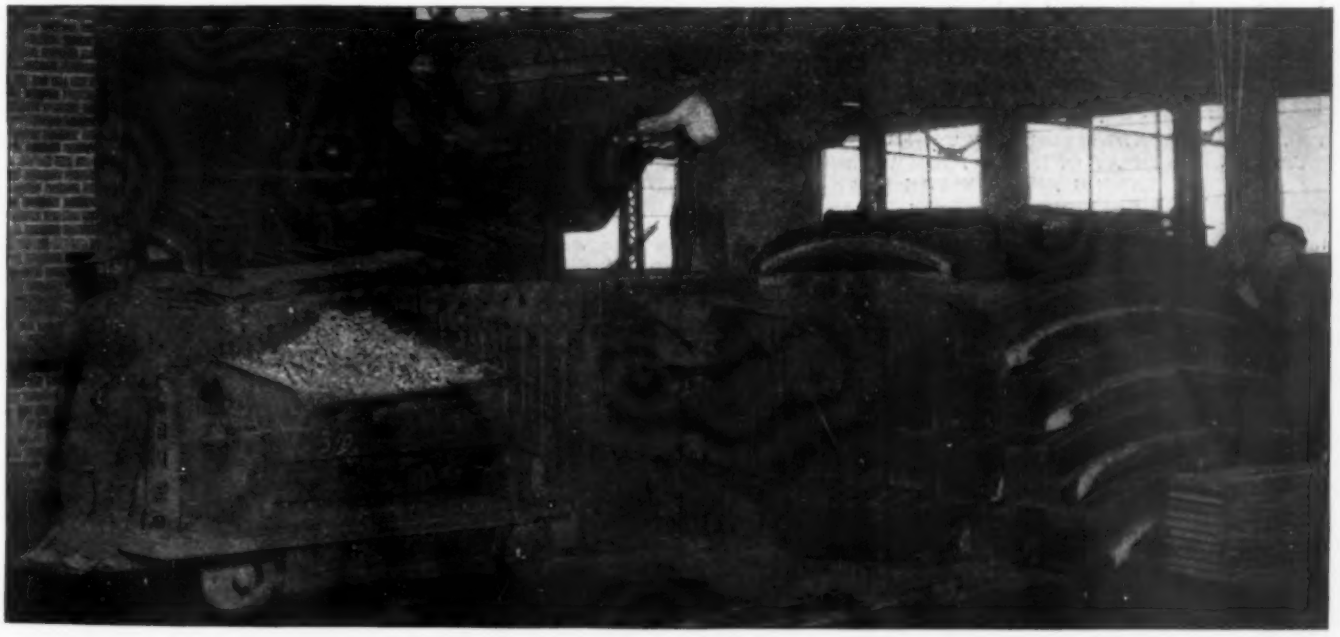


FIG. 1—SPRUE AND PIG IRON ARE BROUGHT TO THE MELTING FURNACE IN DUMP BUCKETS BY AN ELECTRIC TRUCK—THE BUCKETS ARE CARRIED OVER THE OPEN FURNACE BY A TRAVELING CRANE AND DUMPED

Inc., Chicago, was called upon for designs and specifications for the building and sufficient time was taken to plan a foundry which would best answer the company's needs. The first heat was taken off in March, 1920, but not all the equipment was installed until January of this year when the heating plant was finished.

*Situated in a Small Village*

Temple is a small village about five miles north of Reading, Pa., and the company draws the majority of its help from the village or the country immediately surrounding it. In times of great need molders and laborers may be secured from Reading, but at excess cost. This condition necessitated training a large proportion of the skilled workers, and equipment was adopted with this end in view. A general line of jobbing work is handled, including railroad and automobile castings, and general hardware and saddlery pieces, which vary in weight from 1 ounce to 50 pounds. The total weight of castings made in a normal day amounts approximately to 20 tons.

A U-shaped building has been provided with a core room in a separate structure at the one end of the molding and melting department, and an office building a short distance in front. The foundry is constructed of brick and glass with a central monitor of the Pond-truss type. As may be noted in the plan of the foundry, shown in Fig. 2, the molding department, 68 x 144 feet, is divided into a central bay 38 feet wide and two narrow side bays. One of the two melting furnaces is located near each end of the central bay. Cores are brought from the core room, conveniently located, and the castings are carried to the hard-iron cleaning room, a narrow space 24 feet wide at the end of the molding department and forming the base of the U. In addition to the hard-iron cleaning room, a stock room for molders' supplies also is located in this section. Castings are moved from the hard-iron cleaning room to the annealing room which occupies the lower portion of the second leg of the U. From here castings pass along to the soft-iron cleaning department and to the sorting tables, then to the shipping department. The extreme end of this leg of the U is devoted to a pattern vault, a small stock room and a machine shop. With this arrangement castings move in a continuous line from the time they are cast until they are shipped.

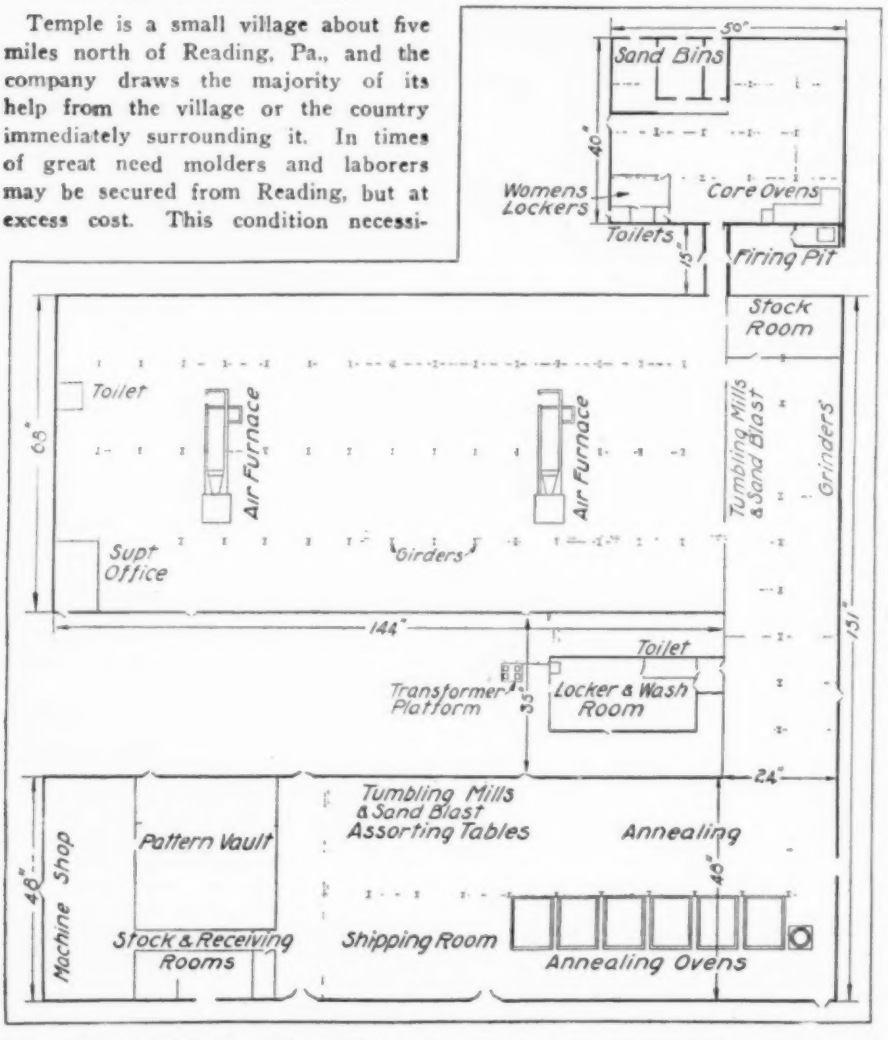



FIG. 2—THE FOUNDRY BUILDING TAKES THE SHAPE OF A *U*, AND MELTING AND CASTING BEGIN AT ONE END FROM WHENCE THE CASTINGS ARE CARRIED TO THE CLEANING ROOM IN THE LOOP AROUND TO THE ANNEALING DEPARTMENT AND ON TO THE SHIPPING ROOM

Metal stock is brought from the yard in buckets carried in a frame on an electric truck. One of these buckets filled with sprue may be seen standing on a truck to the left in Fig. 1. Another bucket is shown being dumped. The workman to the right on the furnace holds a sleeve which is around the carrying yoke and fits over a tongue attached to the bucket. When the sleeve is raised it releases the bucket, allowing it to turn and dump its load. The buckets are carried over the furnace by a small electric traveling crane controlled from the ground by cords. The crane has a 50-foot span and travels lengthwise of the furnace.

Two heats are taken from one furnace each day, the two furnaces never being used together. The maximum taken from a heat is 20 tons, although smaller heats are run according to the requirements of the foundry. Both furnaces are hand-fired with gas coal. The first heat of the day is poured as soon as the molders get to work, having been charged by the night gang and the blast put on about 1 o'clock in the morning. This heat fills all the molds on the floors and then molding is continued until the second heat of the day is poured at the close. This arrangement requires that the molds for two heats shall be on the floor at the same time as no molding is done at night. To conserve floor space, the molds are piled two high on many of the floors. Then a first single row of molds is poured and the weight shifters, after dumping these molds, the top molds of the second row is set on the ground, the slip jackets and weights are placed and another row is ready for pouring. This operation is not arduous and the men who shift weights do not feel burdened by having to place the upper row of molds on the ground.

*Sand Cut by Machine*

After the last heat of the day has been poured, the night gang dumps the molds, gathering the gates of castings near the gangway and stacking the bottom boards and slip jackets conveniently for the molder. The molding sand is then cut by a sandcutting machine manufactured by the American Foundry Equipment Co., New York. This machine cuts all the sand from a heat in about 2½ hours. The morning heat is handled in the same way,

except that after the gates of castings are separated the castings are knocked off the gates and sent to the hard-iron cleaning room in boxes carried by an electric truck, as indicated in Fig. 3. It is intended to replace the boxes with skids in the near future. At the lower corner of this illustration may be seen the end of a floor of molds showing one mold set on another. The electric trucks used by the Temple company were made by the Elwell-Parker Electric Co., Cleveland.

The molding machine equipment is an indication of how the work is handled. Plain power squeezers predominate. Thirty of these were supplied by the Federal Malleable Co., West Allis, Wis., and 12 were furnished by the Adams Co., Dubuque, Iowa. One plain hand squeezer supplied by the Moline Iron Works,

FIG. 3—CASTINGS NOW ARE PILED IN BOXES AND CARRIED TO THE CLEANING ROOM, BUT SKIDS WILL BE EMPLOYED

Moline, Ill., is used. Besides these machines 2 jar-squeeze, 2 jar, stripping-plate and 1 rollover machine from the Tabor Mfg. Co., Tacony, Philadelphia, also serve for a certain class of work. The remainder of the 90 molding floors are supplied with benches for hand-ramming snap flasks.

An interesting job which is made on a bench and hand rammed is shown in Fig. 4. The casting which is a lever for a car coupler is shown at the bottom. Above this is the hard match and at the top a drag before the pattern has been drawn. As may be noted four gates feed each of the two castings in the mold and two gates each feed one of the castings near the cored bearing. The mold is poured at two places as indicated at *A*, *A* on the runner. The special feature of this job is that although it is made in a 10 x 40-inch flask it is molded

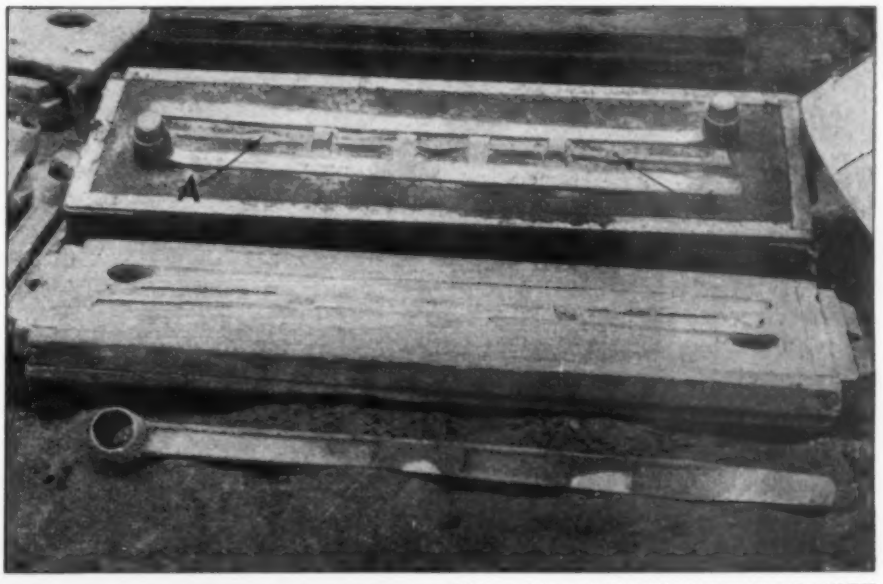


FIG. 4—TWO LEVERS ARE MADE WITH A HARD MATCH ON A BENCH—ONE MAN PUTS UP 38 MOLDS A DAY

on a bench and hand rammed. A man makes 38 of these molds in a day.

Another unique job is shown in Fig. 5. The novelty of this casting is that a malleable iron hook is cast into a thin ring of malleable iron in such a manner that when annealed, the hook turns freely in its socket. The pattern for the hooks consists of an H-gate to which 64 hooks are attached. The hooks after being cast and cleaned are covered with a coating of oxidizing oil, then the swivel, the portion which is to be surrounded with the section of the ring casting, is dusted with sand. The sand is held by the oil and after the castings are baked there is little possibility of the

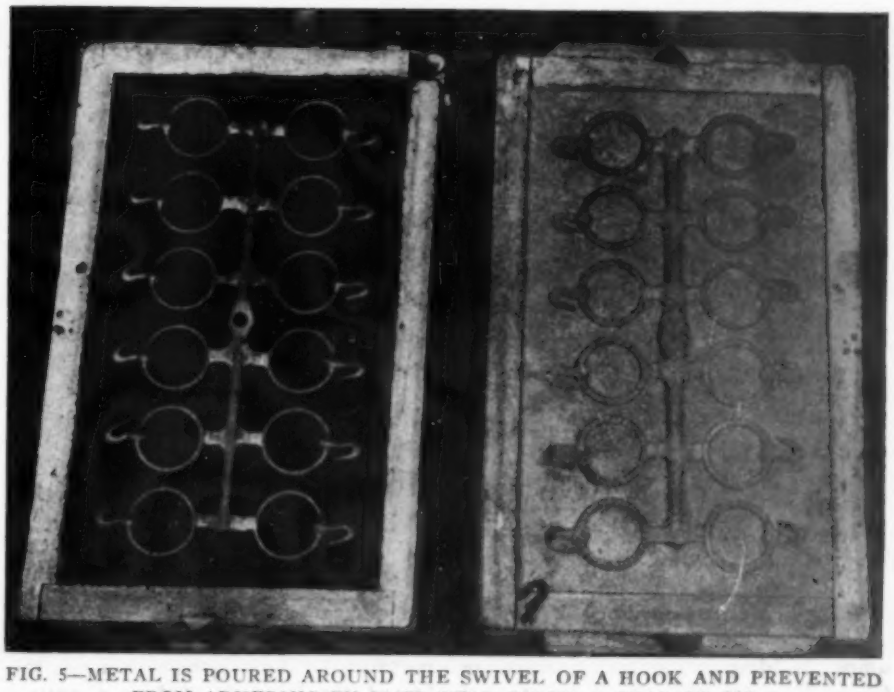


FIG. 5—METAL IS POURED AROUND THE SWIVEL OF A HOOK AND PREVENTED FROM ADHERING BY SAND HELD ON BY A COAT OF OIL

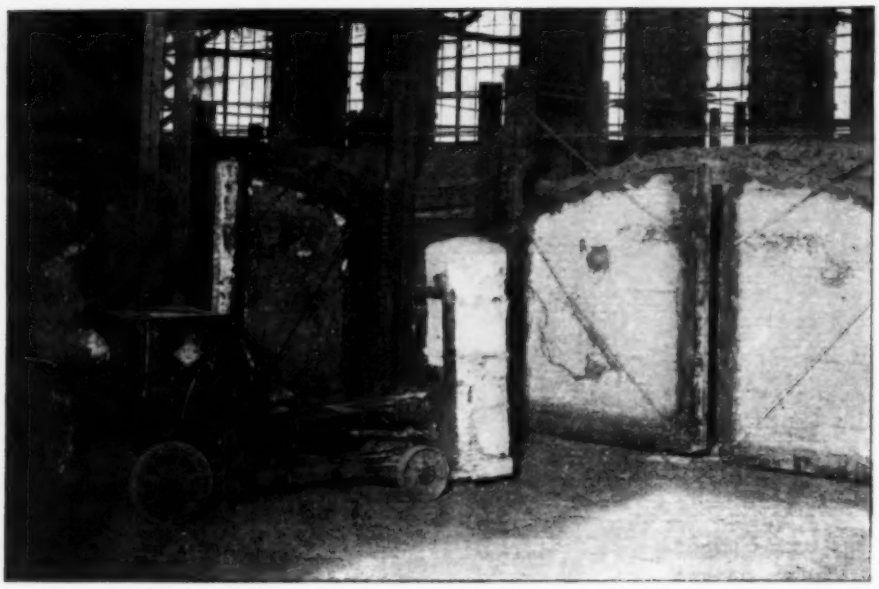


FIG. 6—THE DOORS OF THE ANNEALING FURNACES SWING ON HINGES—LIGHT-WEIGHT INSULATING BRICK MAKE THIS POSSIBLE

sand falling off. The mold is made from a hard match shown to the right in Fig. 5. One of the hook castings may be seen at the bottom of the flask. At the left of the same illustration is shown a drag before the pattern has been drawn. After the pattern is drawn, hooks are set in the indentations left in the mold for them. A molder puts up 160 molds a day. A little rivalry is noted between the men as to which can secure the greatest output. The molder who holds the record has produced 1425 molds in a week in a 12 x 16-inch flask on a power squeeze machine. While both the castings described are made on a hard match, the company encourages its customers to furnish plates or stripping-plate patterns.

The commodious core room, as has been mentioned, is in a building separated from the molding department, but the two are connected by a covered runway and the cores are easily delivered to the molding floors. A large number of the employes of the core room are girls selected from the families in the small town of Temple and taught to make the cores.

A binder with a linseed-oil base is used for the larger percentage of the cores, but a few heavier cores, when made with this binder have been found to be too strong and not to crumble after the iron is poured. Such cores are made with a rosin binder. All classes of cores are baked in the same oven. The heavier cores are placed on the top of the racks which are moved about the room by a hand lift truck. The top, being hotter than the bottom of the oven, dries the heavier cores as quickly as the lower portion of the oven bakes the smaller cores. No distinction is made between the rosin and oil cores in placing them in the oven, unless they are of different sizes. The cores bake in 2 hours; 1 hour being required to heat the oven to 450 degrees Fahr., at which temperature it is held for another hour.

*New Design Annealing Ovens*

When the castings are knocked off the gates, the latter are loaded into buckets, weighed and assembled for the next heat while the castings are carried to the cleaning room as has been noted. Here they go either into tumblers or are sandblasted by hand in a small room. Chipping and grinding the castings also is done before the product goes to the annealing department to be packed and baked.

The annealing department contains six ovens designed by Enrique Touceda, each with a capacity of approximately 20 tons of castings. The company reports the ovens to be giving good satisfaction, although they were among the first ones of this type designed by Mr. Touceda, and the later ovens have been somewhat modified. Several novel characteristics may be noted. The main feature is the way the coal is burned. Forced draft is used and air also is fed above the fire similarly to the top draft in air furnaces. The gases pass out of the furnace through three flues near the bottom on each side. The three ports on one side may be seen in Fig. 7. After the furnaces had been started it was found advantageous to brick a portion of each port to balance the draft with the pressure from the fan which delivers air to the combustion chambers. Anthracite coal of the grade known as river coal is used together with approximately 25 per cent bituminous slack coal. The anthracite coal is a poor grade and is secured at a low price, but even with this grade of coal a ratio of 1 of coal to ½ of castings is secured in annealing. The roof of the furnace has a considerable slant from the firing end of the doors. These doors swing on hinges, which is made possible by lining them with an exceedingly light weight grade of insulating brick. The doors do not entirely cover the opening of the furnace, but a space the length of a brick remains between them when they are closed and a similar space is left between the doors and the floor

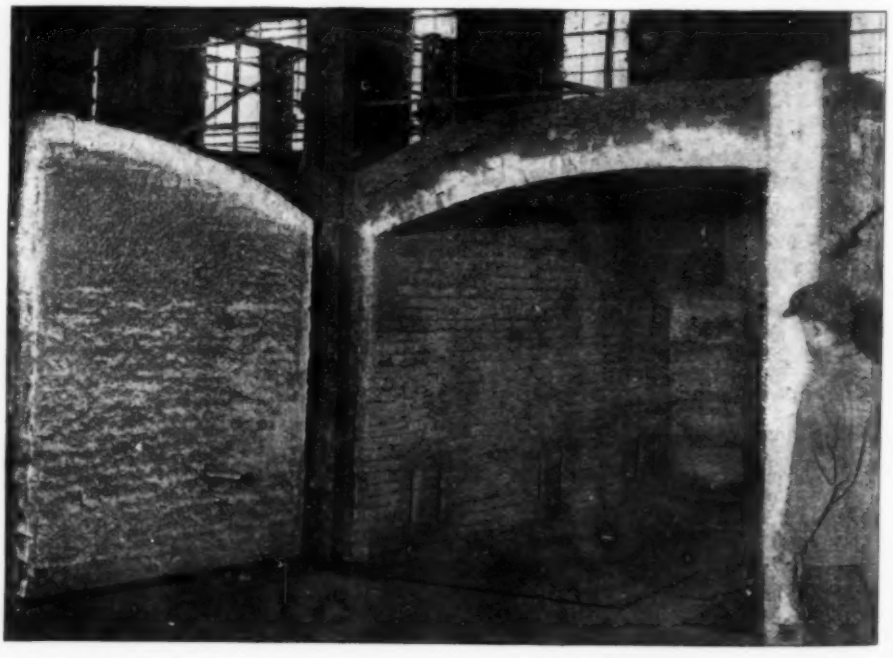


FIG. 7—THREE PORTS ARE LOCATED NEAR THE BOTTOM ON EACH SIDE OF THE ANNEALING OVENS—THESE PORTS HAVE BEEN PARTLY BRICKED

of the oven, as may be noted in Fig. 6. These spaces are bricked and luted after a charge is in the oven.

The ovens are not forced to heat quickly but are heated slowly, about 35 hours being taken to bring the heat to 1550 degrees Fahr. This temperature is maintained for 72 hours, after which the furnace is cooled about 10 degrees an hour until the pyrometer records 1000 degrees. At this point the brick which close the space between the doors is taken out, leaving a space for the air to enter and accelerate the rate of cooling of the oven. When the pots are cooled well below a black heat, the first row is drawn by a storage battery truck with lifting tongs which may be seen in Fig. 6. The front wheels of this truck are steel but the rear wheels have rubber tires. Therefore, after the first two or three rows of pots are withdrawn no more are taken from the oven until the floor of the oven is cool enough to allow the rubber to pass over it without burning. The pots taken from the ovens are dumped in a pile on the annealing room floor and the castings are taken to the sorting benches in wheelbarrows.

*Recording Pyrometers Used*

As may be noted in Figs. 6 and 7, which show the thermocouple extending through the door to the left, pyrometers are used on the ovens. These thermocouples are formed of chrome-nickel and nickel wires and are attached to a recording instrument made by the Thwing Instrument Co., Philadelphia. An indicating instrument connected with a 12-way switch serves to enable the operator to check the recording pyrometer at any time by connecting the thermocouple in any of the furnaces to the indicator. The recorder is a double-chart instrument with each chart arranged to record the temperature of three thermocouples. In this way the temperature of any one or of all of the ovens may be recorded.

FIG. 9—THE SORTERS THROW THE CASTINGS INTO DRUMS WHICH ARE CARRIED BY A SPECIAL TRUCK TO THE COMPUTING SCALES

Castings from the anneal are cleaned on a rotary sand-blast table, in a sand-blast barrel or in tumblers. From the cleaning room they are carried by wheelbarrow to the sorting tables shown in Fig. 9. A laborer wheels the casting up an inclined runway to a raised aisle between two rows of benches. The castings are dumped on the proper benches from the wheelbarrow and the sorters throw them into steel drums. These drums are handled by a truck. Two prongs on the truck engage a lug on both sides of the drum and raise it off the floor. It then can be wheeled to any desired place and is dumped by the laborer handling it. To do this he tilts the truck back until it rests on the curved brace upon which he has his foot. In this position the center of gravity is so located that one weight rests on the brace and the drum may be swung on the lugs acting as pivots and turned around to allow the castings to fall out.

*Keeps Records of Castings*

When sorted, the castings are carried in the drums to a platform weighing and computing scales. With this scales it is possible to determine the number of castings in the drum by placing a few of the castings in a receptacle on the scales arranged for this purpose. After determining the number of castings in a drum, it is necessary to record their manufacture to prevent too many castings being made. The method for doing this at the Temple plant is extremely interesting. At the time the pattern is sent to the foundry duplicate loose leaf sheets are made out. These sheets, as may be seen in Fig. 8, contain at the top the customer's name and address as well as the route over which the castings are to be shipped. Also at the top to the right is a space for the order date and the order numbers of the customer and the Temple company. At the left end of the sheet the words *grind* and *straighten* appear

*(Concluded on Page 185)*

NAME Daniels Motor Car Co.
ADDRESS Reading Pa.
SHIP VIA P & R

ORDER DATE 11-19 1919

| THEIR NO. | OUR NO. |
|---|---|
| 12403 | 12846 |

GRIND No. STRAIGHTEN No.

7 1/16"

11B133

| PIECES 100 | PIECES | PIECES | PIECES | PIECES |
|---|---|---|---|---|
| PAT. 11B133 | PAT | PAT. | PAT. | PAT. |

| DATE | PIECES | DATE | PIECES | DATE | PIECES | DATE | PIECES | DATE | PIECES |
|---|---|---|---|---|---|---|---|---|---|
| 1/16 | 15 | | | | | | | | |
| 2/27 | 2 | | | | | | | | |
| 3/8 | 52 | | | | | | | | |
| | 69 | | | | | | | | |
| 4/8 | 15 | | | | | | | | |
| 5/22 | 21 | | | | | | | | |
| | 105 | | | | | | | | |

FIG. 8—CASTINGS ARE IDENTIFIED BY SKETCHES PLACED ON FORMS ON WHICH A RECORD IS KEPT OF THE NUMBER PRODUCED

# How to GetBack to Normal Quickly-I

## Business Paralysis Which Now Exists Finds Its Origin in Gross Misapplication of Basic Principles of Cost and in the Varied Computation of Prices—Method for Handling Accounts Outlined

BY C. E. KNOEPPEL

*TO THE foundryman who, only a few months ago turned away orders from his crowded plant and who today is limping along on part time operation with little new work in sight, Mr. Knoeppel's message has a marked appeal. He suggests a remedy for the present business paralysis. The remedy which is proposed constitutes more than an economic theory. It has been proved by actual practice in a number of manufacturing establishments and if universally followed would serve to level to a normal plane the price curves of commodities which at present swing too far through peaks and depressions. This article contains the substance of two addresses made by Mr. Knoeppel, who is president of C. E. Knoeppel, industrial engineers, New York. The first of these was at a joint meeting of the Chicago Society of Industrial Engineers with the Western Efficiency society, and the second at the session of the New York chapter of the National Association of Cost Accountants and Society of Industrial Engineers.*

AMERICAN industry is operating at no greater than one-half of its full capacity. It should be operating at normal capacity and can do so quickly and successfully.

It is possible to reduce unemployment to minimum. Drastic wage cuts can be avoided. Industry can sell much more of its products than it is doing. Plants now idle can be operated, and those working on part time can increase their hours. The use of credit capital can be directed more safely and more surely than at present. Foreign trade can be greater than it is.

All of this may sound radical and utterly foolish.

However, analysis proves differently.

It is agreed generally that plenty of business lies ahead. In fact, the available statistics clearly indicate this. Our children need schools; our families need homes; our cities require new public buildings; our automobiles, trucks and farmers need roads; our railroads need repairs, new tracks, roadbeds and equipment; our public utilities need betterments and replacements; our furnaces and stoves require fuel; our people need shoes and clothing. In addition to all of this, the world needs food.

The present situation can be best expressed as follows:

No selling, no buying;
No buying, no making;
No making .....
Then what?

Falling sales and decreased production are causes leading to depression and business stagnation, resulting in unemployment, idle plants, high costs and heavy losses, which are inevitable unless we take constructive steps to get back to normal.

A well-known axiom of business holds that in periods of depression or reduced demand, costs of production are so high, that prices based on them will not secure the required amount of business to operate plants at possible capacity. As a result, costs are ignored, and prices go tumbling in the effort to stimulate the purchase of commodities, the basis of which is judgment based on fears of losing business, or going out of business, instead of a predetermined and scientific basis for determining and knowing what rock bottom prices should be.

### *Expansion Brings Low Cost*

On the other hand, in periods of expansion, costs are low due to volume of production, purchasing in large quantities, and other reasons. Figures based on costs, result in prices less than the plants are able to get for their products. Again, costs are ignored and judgment forms the sole basis for prices. Both of these conditions seem to support the contention, so often advanced, that there is no relation between cost and price, and costs are not used as a basis for price making at all.

The actual procedure in price making unfortunately is based on such knowledge as may be available as to competition, demand, available supply, the financial situation, what the traffic will bear, or the low points necessary to book orders. The significant fact in connection with all of this is that at only one time in a business, is there a positive relation between costs and prices, and that is when a plant is operating at normal capacity. Even then, the margin of profit added to costs to make prices is many times a gamble as to how much can be added, and still not lose the business.

Here, then, are three important conclusions for the benefit of American industry, as a whole:—

If operating at normal capacity means prices which yield business why not determine and use prices which reflect normal capacity?

If, in times like this, judgment used in determining prices is based on fear instead of predetermined estimates, isn't it better to have scientific knowledge of what will secure business than to operate blindly?

If losses must be sustained to secure sufficient orders to remain in business, isn't it better to know how far these losses can go and for how long, without positive detriment to the plants?

These points raise this economic and vital question:

How far can industrial plants go below normal capacity and remain in business, and what is the point at which orders will begin to come in?

This, then determines the first fundamental principle of getting back to normal quickly:

1—*Determine the normal capacity of machines and working places by departments, in hours. This would be 75 per cent to 80 per cent of the possible, or 100 per cent, capacity.*

If, you assess all of the cost of operating a plant at one-half capacity, against the products produced by this reduced capacity, could you get prices

based on these figures? In other words, the proportion of overhead in a department or plant, to assess against production, should vary in the ratio of the capacity actually employed on production to the capacity that could be employed.

Would you assess all of the overhead of two plants on one plant, if one of the plants should stop work? If you buy a suit of clothes and find a hole burned in it, would you pay for two suits when you get the replacement? If material in an article costs a firm $10 and when you buy the article the material has increased to $15, should you pay the other $5 which the concern did not have to pay?

This, then, determines the second principle of getting back to normal quickly:

*2—Standardize overheads according to departments, with due consideration to reducing them where possible, determining what the rates would be at normal capacity.*

It is well-known that in industry, effectiveness varies directly in proportion to productivity, or to put it more simply as the work actually produced per hour approches that which should be produced per hour, the greater the relative accomplishment. A worker getting 60 cents per hour, working 8 hours per day and producing 10 pieces per hour, is of much more value from an economic standpoint, than one working 10 hours per day, at 45 cents per hour, and producing 5 pieces per hour. The cost in the first case is 6 cents per piece, while in the second it is 9 cents, or 50 per cent higher.

### *Human Effort Is Purchased*

What people buy when they purchase goods is not the physical things they see, but hours and minutes from president down to office boy. Time is the real investment in industry, and governs the cost directly.

Normal conditions require normal hourly outputs. Therefore, it is obvious that what should be produced must be known in order to determine currently the relative attainment.

Hence the third principle of getting back to normal quickly is:

*3—Determine from estimates, records of past performances, conferences, or by observations, what would be fair and attainable production standards per hour for the various operations, using normal capacity as a basis.*

Knowing the normal capacity for machines and working places, according to departments, having definite standards of the time which should be taken for the various operations to produce the units of product, and the basis for the fourth principle of getting back to normal quickly is determined:

*4—Determine quantities of the various combinations of products a plant can make at normal capacity.*

The estimated time it takes to do work now is a known factor; the current labor and material rates are known; the overhead rates have been standardized; the quantities of products which can be made, have been developed; all of which serve as a basis for the fifth principle of getting back to normal quickly:

*5—Determine for normal capacity the cost of the products which can be made.*

Inasmuch as the greatest volume of business goes to that concern whose prices reflect normal operating conditions, the matter of price making is next in order. In most cases at present, costs are too high to mean prices which include fair and reasonable profits. Plants are concerned with getting enough business to remain active. Salesmen are doing all in their power to make prices low enough to justify purchasing, the result being that present price making has as its basis, pessimism on the one hand, and fear on the other.

Firms know that in these times, losses must be sustained. The serious question to them is how much the losses will be, and how long they will last before an upward trend sets in. Some may be selling at a profit; but the majority can only be selling at, or below, cost to produce.

The curse of American industry is its unintelligent competition. Consumers, as a rule, are the only ones to benefit by the uneconomic and incorrect methods of costing and pricing in use by so many firms. There must be losses before we can get back to normal, and this generally is admitted as necessary. Then no logical argument exists against substituting for judgment and guesswork, some plan which will make losses a matter of intelligent, systematic and scientific determination. This must be done if business is going to get away from playing the business game, like the card player who bets before looking at his hand.

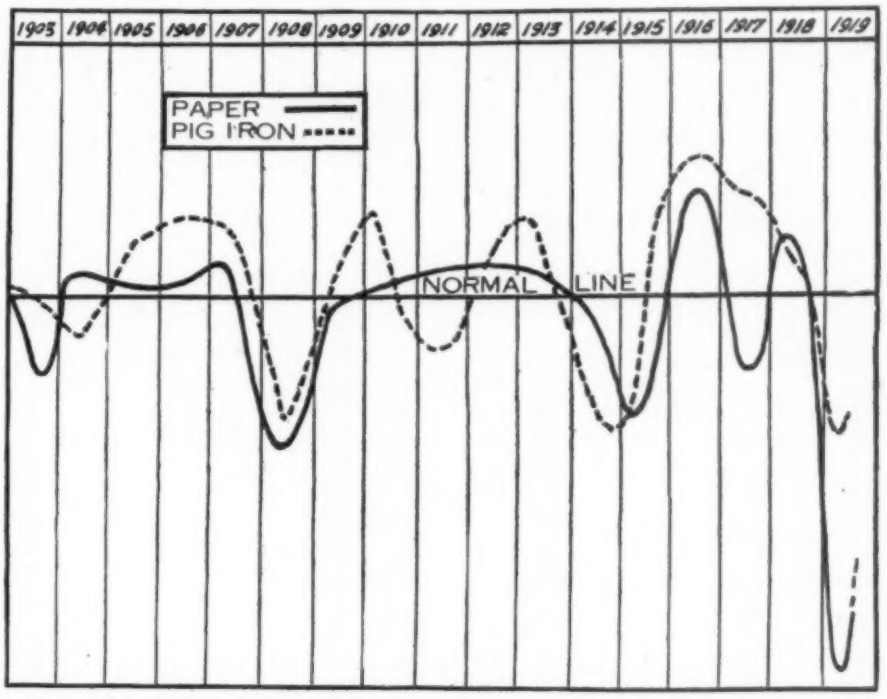



TABLE OF PRICE FLUCTUATIONS ABOVE AND BELOW NORMAL FOR THE PAST 17 YEARS IN TWO BASIC COMMODITIES

-ovide

### *Substitute Knowledge for Guessing*

At any rate, by observing the above principle, we would know what standard costs should be at normal capacity, through the use of standardized overheads, using time estimates for the various operations at current rates, and current prices for material. We know what actual costs are for the actual volume of work produced. We also know, or can ascertain, what costs have been at full capacity.

From such figures, charts may then be developed, showing costs at 60 per cent, 70 per cent, 80 per cent and 90 per cent of capacity, which will serve as the basis for the sixth principle of getting back to normal quickly:

*6—Determine prices which reflect normal conditions, using a normal profit as the factor to add to costs, in so doing.*

If you must go under this figure to

get business, you have at least the basis for knowing what is a normal price, and any deductions from normal prices then are made openly and with knowledge of the effect of so doing.

In this connection, the importance of considering relative complexity of work in determining prices is evident. Generally it is accepted that consumers should pay most for that which costs most to produce. For instance, three pieces of work may cost $1000 to produce. If 20 per cent is added to the cost for profit, the price in all cases is $1200. In one there may be $500 worth of labor and overhead; in the second, $400; and in the third, $300. No provision has been made for considering the degree of complication in this method of calculating price, and as time of workmen and equipment is the prooductive investment in business, a concern should get more in profit for the work taking $500 in labor and overhead, than the one taking $300; and this the price making method should reflect. This spells a smaller percentage of profit in materials and a much greater percentage of labor and overhead; this to vary in proportion to the increase of the labor and overhead.

*Gambling on Futures*

It may be said that selling goods on anticipated normal means *playing the market short.* My answer is that, inasmuch as you cannot sell goods at the prices you want to get for them at this time; inasmuch as you must pocket *some losses* until normal is again reached; inasmuch as prices based solely on pessimism and fear, may be ruinous in the end, why not play the market short willingly and knowingly, but *safely?* Therefore, why not, put these losses, due to the present business conditions, where they may be seen and analyzed, and use them as a guide for later decisions?

Hence the justification for the seventh principle of getting back to normal quickly:

7—*Charge the difference between actual and standard overhead into an adjustment account, the balance of which can be carried at the end of the year, to profit and loss.*

This charge will decrease as normal is approached and cease as it is attained. As normal is passed and possible capacity is exceded, the total charges will be offset in whole or in part by credits to this adjustment account.

The time may come when the differences between actual cost of direct labor and what these costs should be, will be handled as outlined for overhead costs, but this is for the future to determine. At present, what has been outlined is advocated for the present, as many firms are successfully using the plan mentioned.

In carrying out the provision outlined the burden account would be charged with the actual expenditures; the work-in-process would be charged with the standard overhead; while the difference between standard and actual overheads would be charged to a *Burden Profits and Loss Account.*

In respect to materials of staple nature, such as pig iron, scrap iron, coal and coke, it also will be of value to use a *Material Adjustment Account,* which will exhibit the profit and loss, as between the purchase-price of material, and the price which is charged into the cost. For instance, if the average cost of pig iron as purchased is $35 per ton, and the market drops to $25 per ton, the cost records would be charged at the rate of $25 per ton on the tonnage used, the *Material Adjustment Account* being credited with the same figure. At the same time a second entry would credit the inventory account at the actual cost on the tonnage used, with a corresponding charge to the *Material Adjustment Accounts.* This would clear the actual cost from the inventory and would concentrate in the *Material Adjustment Account* the loss on the material used, enabling the cost to be figured on the basis of the *normal* condition which existed at the time material was used.

The adoption of the principles set forth will do more to stabilize industry, and keep it stabilized, than any other one thing, and my conviction is that labor is never going to be willing to do its share in turning out quantity production, and using labor-saving equipment until, through stabilization, we work normally in industry for longer periods, thereby reducing unemployment and the seasonal high and low peaks of demand for labor, as well as equipment and materials—all of which consitute another reason why these principles should be adopted.

At any rate waiting for prices to drop when prices are high, stifles demand to too great an extent; while buying too much when prices are low stimulates demand to too great an extent. In other words, unscientific buying in dull times, makes for false demand, and an unwarranted increase in production arises which like the "wash sale" on the stock exchange, puts prices on too high a basis. This in turn causes a stoppage in buying because of the high prices, resulting in an unwarranted decrease in production, forcing prices on too low a level. If we produced pig iron in dull times, we would not have an abnormally low price, and we would have pig iron in good times without the abnormally high prices.

Here is what happens in periods of depression or inactivity, or low price levels. Concerns stop producing materials. Not only are men thrown out of work, which is bad enough, but there are also losses to consider, due to idleness in the use of machinery, plant, materials and in money—a severe economic loss all along the line, all of which makes for high production costs. In periods of stimulation, over-activity and excessive demand, plants are run at full blast, to the detriment of the plants, while costs increase because of inefficiency, due to using labor not suited to the work, increased rejections, greater labor turnover, confusion, lack of co-ordination and other factors. In other words, whether producing in unusually slack times or unusually busy times, the conditions met make high costs. If productions were kept on a more normal basis throughout the year, we would avoid wide price ranges.

*Avoid Peaks and Pits*

Another factor must be considered in this connection. To have available the equipment and facilities necessary to produce in periods of expansion means that when normal is reached there is an idleness of these industrial facilities which increases as production drops.

To maintain the LEVIATHAN in idleness in New York Harbor, is costing this government $780,000 per year. What then must be the cost of idle machines, idle floor space, idle cars and locomotives, and idle men in industry at a time like this?

The question of storage and financing enters into this phase of the discussion, for it will require space and money, as well as knowledge of fundamental business conditions, to keep on manufacturing in periods of low demand. However, it can be done. If the manufacturers of pianos, jewelry, candy, shoes, underwear, socks, stockings, and clothing were to wait until the demand struck them before starting to produce, you can well imagine what we would have to pay for these products. However, what they do, is to produce as near to normal as possible throughout the year. Knowledge of sales conditions, financing and storage space, are provided.

What would happen if all the grain elevators and cold storage plants should suddenly burn? Or to put it another way what is to prevent us from handling basic commodities the same as the products we grow or raise and place in elevators and storage plants?

(TO BE CONCLUDED MARCH 15)

# Solving Some Arc Welding Problems

## Mild Steel Castings Are Easiest to Weld; Next Comes White Cast Iron; Gray Cast Iron; Malleable Iron; High-Carbon Cast Steel and Finally Nonferrous Castings

BY A. M. CANDY

FROM the welding standpoint it appears logical to consider foundries as usually being in one of three general classes: (1) those making castings exclusively for the trade; (2) those operated by and exclusively for large manufacturing organizations; and (3) those operated both for general trade and one or more manufacturing organizations. It is the writer's opinion that foundries in the first and third classes will of necessity be most exacting in requiring sound welds because the trade will be inclined to look upon a welded casting as being a second hand product until all interested parties are educated to the physical characteristics of good welds and how good welds can be produced and verified by inspection and tests. It is the purpose of this paper, to discuss the various factors upon which good welding is dependent and to present physical data pertaining to good arc-deposited metal. To discuss the various phases of the welding problem it is probably best to enumerate the many variable factors in the order of their relative importance, the first being considered the most important:

1. Physical and chemical characteristics of material proposed to be welded.
2. Welding education of supervisor or welding foreman. Also training and skill of welding operative.
3. Physical, chemical and electrical characteristics of electrode or metal to be used for forming the weld.
4. Physical and electrical characteristics of apparatus to be used for supplying welding energy.

The physical characteristics of arc welds and arc-deposited metal in which all foundrymen are primarily interested are entirely dependent upon the four factors cited. To conserve space and time it will be possible to consider only the most important features.

Castings are made in such an infinite variety of sizes and intricately cored shapes that it is practically impossible to make definite statements as to methods of welding procedure which are broadly applicable. For example, cast iron is relatively weak in tension. It also has very little ductility. The strains incident to welding and subsequent cooling are of great importance. It is not unusual to have a casting submitted for repair which could be welded much more easily if preheated before welding. Owing to the intricate shape, however, preheating may be difficult or out of the question due to the distortion which would be produced. If the latter is true it may be necessary for the operator to perform his work relatively slowly so as to keep the heating, due to the arc, at a minimum and in addition, it may be advisable to provide an auxiliary cooling medium such as an air blast. The chemical composition of a casting determines to a great extent the ease with which it can be welded. In general, the higher the percentage of carbon or other alloying constituents the more difficult it is to weld. In the order of their relative ease of welding beginning with the most desirable, castings rank as follows: Mild steel castings, white cast iron, gray cast iron, malleable cast iron, high carbon cast steel, and nonferrous castings, including aluminum, brass, bronze, etc.

Especially in the field of iron castings there are many different grades produced by varying the processes. For

### Table I

### Composition and Size of Welding Wire

1—Chemical Composition:

| | Per Cent |
|---|---|
| Carbon | —not over .19 |
| Manganese | —not over .55 |
| Phosphorus | —not over .05 |
| Sulphur | —not over .05 |
| Silicon | —not over .08 |

2—Sizes and weights:

| Diameter fractions of inch | Diameter decimal equivalent | Pounds per 100 feet | Feet per 100 pounds |
|---|---|---|---|
| 3/16 | .125 | 4.16 | 2400 |
| 5-32 | .156 | 6.51 | 1535 |
| 3-16 | .188 | 9.37 | 1066 |

Allowable tolerance .006-inch, plus or minus.

3—Material—The material from which the wire is manufactured shall be made by any approved process. Material made by *puddling process not allowed.*

4—Physical Properties—Wire to be of uniform homogeneous structure, free from oxides, pipes, seams, etc., as proved by microphotographs.

5—Workmanship and Finish—(a) Electric welding wire shall be of the quality and finish known as the "bright hard" or "bright soft finish"—"black annealed" or "bright annealed" wire shall not be supplied.

(b) The surface shall be free from rust, oil or grease; a slight amount due to lubrication during last drawing being permissible.

6—Tests**—Electrodes must, before shipment or after delivery, show good commercial weldability when tested by an experienced arc welder. The electrode material shall flow smoothly in relatively small particles through the arc without any detrimental phenomena.

7—Delivery, Packing and Shipping—Electrodes shall be furnished in straight lengths of either 14 or 28 inches, put up in bundles of 50 or 100 pounds, as ordered. Each bundle shall be wrapped in heavy paper, securely wired, and marked on one end showing diameter in fractions of an inch, trade name and grade of wire.

Note:

*This wire may or may not be covered.

**If electrodes to above specifications sputter or flow unevenly, dip same in milk of lime (whitewash) before welding. This dipping may be done in quantity on stock on hand and allowed to dry, or welder may keep a pot of solution on hand into which the electrode is dipped immediately before welding.

From a paper presented at the Columbus convention of the American Foundrymen's association. The author, A. M. Candy, is connected with the Westinghouse Electric & Manufacturing Co., Pittsburgh.

eral, where the nature of the work on any grade of cast iron, including malleable, will permit of the use of the graphite electrode process a better weld

FIG. 4—SECOND STEP IN REPAIRING STEEL CASTING

can be made. Although hard carbon electrodes can be used, experience indicates that a lower rate of electrode consumption is obtainable if graphite electrodes are used. Both electrodes are made from the same base and binder but the graphite electrode is produced by baking a carbon electrode at a temperature of about 2000 degrees Cent., which is sufficiently high to graphitize the binder, thereby improving the binding power and homogeneity of the electrode and decreasing its resistance. These electrodes can be purchased in standard lengths of 12 inches and in diameters of 1¼-inch up to and including 1 inch. Each electrode should be kept tapered at the arc end in a conical shape at about 45 degrees, the point being left about ⅛ to $\frac{3}{16}$-inch

FIG. 5—SHOWING COMPLETED REPAIR TO DEFECTIVE STEEL CASTING

the arc. The diameter of the electrode in diameter. The tapered point materially assists the operative in controlling required depends upon the current to be used. The combinations in most common use are about as follows:

| Amperes | Diameter in inches |
|---|---|
| 50 to 125 | 0.25 |
| 150 to 250 | 0.375 |
| 300 to 500 | 1.000 |

When the graphite electrode process is used either on steel or cast ing, during the past two or three years has properly emphasized the importance and, we may add, imperative necessity of training operatives for the arc welding and cutting processes. As a general rule the candidate has only a few weeks at his disposal, therefore it is usually possible to give him only the underlying principles involving the mechanical manipulation of the welding tools and sufficient training to enable him to determine when a reliable weld is being made by inspection of the arc behavior, appearance of the deposited metal both when forming in the molten pool at arc extremity and by inspecting the deposits after being completed. In addition to these factors the welding supervisor or foreman, especially in a foundry, should have a general knowledge of the behavior of various types of castings under heat. He must know what

FIG. 3—FIRST STEP IN REPAIRING DEFECTIVE STEEL CASTING

types of defects can be repaired and must be able to recognize defects which are not susceptible to repair by welding. The judgment displayed by the supervisor in selecting repairable defects arranging for the proper preliminary preparation of the parts to be welded, applying preheating where desirable in a proper manner, and annealing the parts after welding when necessary, together with the manipulative skill of the operative, determine the success of the welding applications. After having seen the exhibits of almost unbelievably poor welding work in the office of A. G. Pack, chief inspector of Bureau of Locomotive Inspection at Washington, the writer does not believe it is possible to emphasize too strongly the necessity of training men to make skilled welders and competent supervisors.

For welding medium and mild steel castings by the metallic electrode process a bare wire electrode conforming with the specifications adopted by the American Welding society, as shown in the accompanying table, will be found amply satisfactory. For welding white cast iron castings the same electrode material can be used. In general, for example, we find very fine grained, white cast iron in which it is much easier to make a good weld, obtaining good fusion and a minimum of porosity or gas pockets. At the other extreme is very coarse grained, gray iron which is a very weak structure. When metal

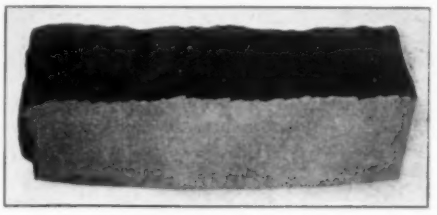


FIG. 1—ARC-DEPOSITED METAL BUILT UP FOR TEST PURPOSES

is deposited on such material by any of the arc processes the zone of fusion is very porous and as a rule a very appreciable amount of blue iron oxide (presumably $Fe_3O_4$) is present. The porosity is chiefly due to the high carbon content of the cast iron. This carbon is volatilized by the intense heat of the arc, forming relatively large volumes of carbon monoxide and carbon dioxide which are trapped by the deposited metal. It is for the same reason that high carbon content steels are more difficult to weld than medium and low carbon steels.

Nonferrous metals such as aluminum, copper, nickel, brass, bronze, monel metal and various other alloys are particularly difficult to weld, due principally to the relatively low melting temperature which results in rapid oxidation forming large volumes of gas, producing porosity and also producing slag inclusions in the deposited metal, particularly noticeable in the zone of fusion. The oxides formed by some of these

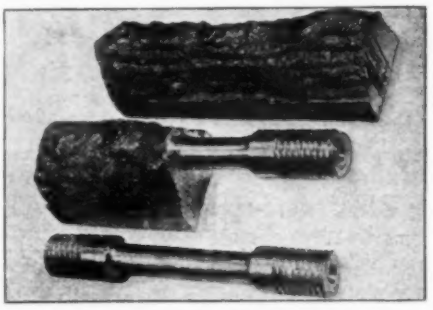
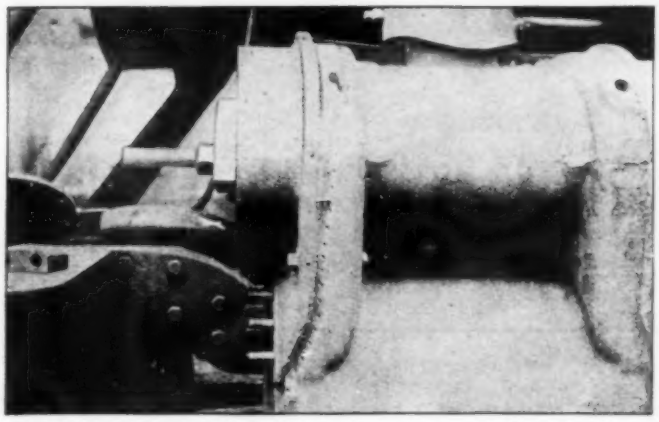


FIG. 2—DEPOSITED METAL CUT INTO THE FORM OF TEST BARS

metals have relatively little conductivity so that if present in the form of a continuous scale of appreciable dimensions the maintenance of an arc becomes much more difficult. Then, too, some of these metals have a very critical melting temperature passing quickly from the solid to a semiliquid state without passing through a very plastic condition. This obviously makes welding difficult.

Welding literature, including advertis-



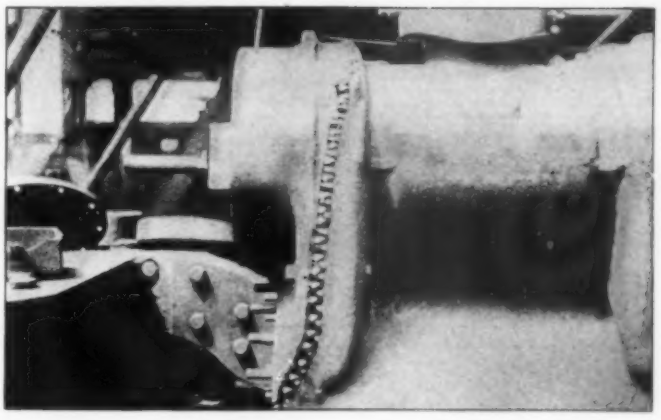


FIG. 6—HOLES DRILLED IN BROKEN IRON CASTING PREPARATORY TO INSERTING STUDS FIG. 7—STUDS IN PLACE PREPARATORY TO WELDING

iron castings the best filler metal is low carbon steel or commercially pure iron in rods of 3/8 or 1/2-inch diameter, depending upon the current to be used. The use of cast iron rods, manganese steel rods, or other alloy rods is not recommended because the resulting deposit usually will be more porous. It is not as easy to obtain good fusion and the deposited metal will be much harder, making the finishing of the weld by machining or grinding much more difficult.

In the field of nonferrous metals probably copper is the most susceptible to welding of any of those listed. However, at the present stage of the art we do not feel warranted in making broad claims for this application.

When working on copper the use of the graphite electrode process and a flux such as borax is usually to be recommended. A skilled operator, even with careful manipulation, is not able to entirely eliminate porosity. Furthermore the fused copper is cast metal and is therefore relatively brittle. At present it is felt that a great deal of development work will be required by electrode metal manufacturers to produce electrode materials better suited to the welding of the various nonferrous metals and their alloys.

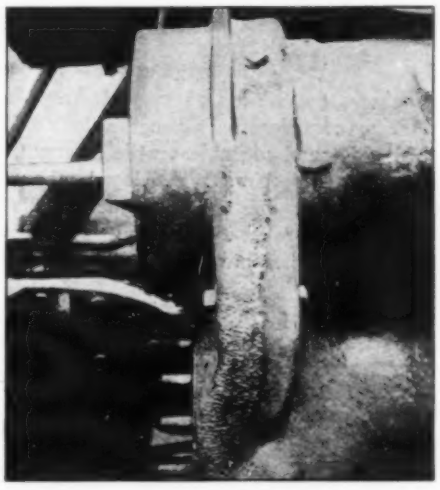
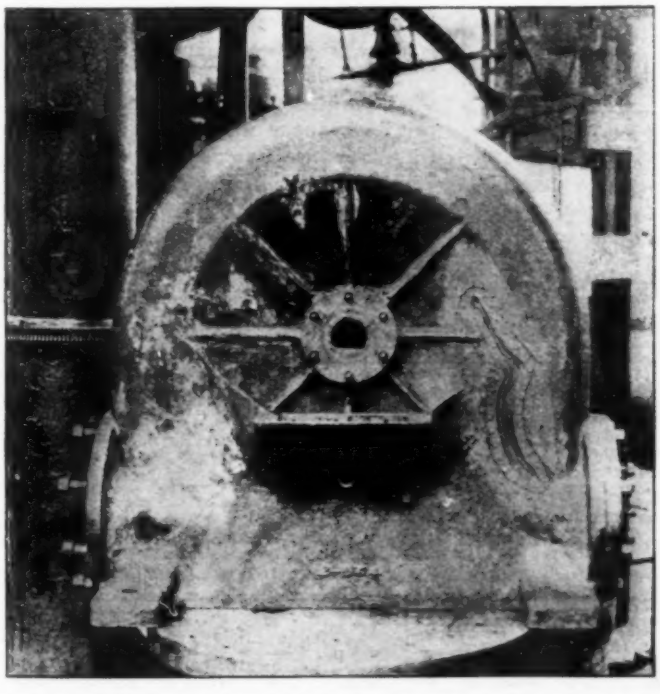


FIG. 8—REPAIRED CASTING SHOWING COMPLETED WELD

To determine the physical characteristics of (mild-steel, bare-metal electrode) arc-deposited metal a 14-pound deposit was built up on a steel plate approximately 1/2 x 3 x 8 inches, the deposit being about 2 inches deep as illustrated by Fig. 1. Standard commercial practice was observed in this work, the operator exercising average care. No cleaning of the deposited layer was performed except by means of a stiff wire brush, no sand blast being used. Using only the deposited metal, two standard tensile test specimens were cut out as illustrated by Fig. 2. Other specimens also were obtained for compression, bending and shear tests. The results obtained are shown in Table II.



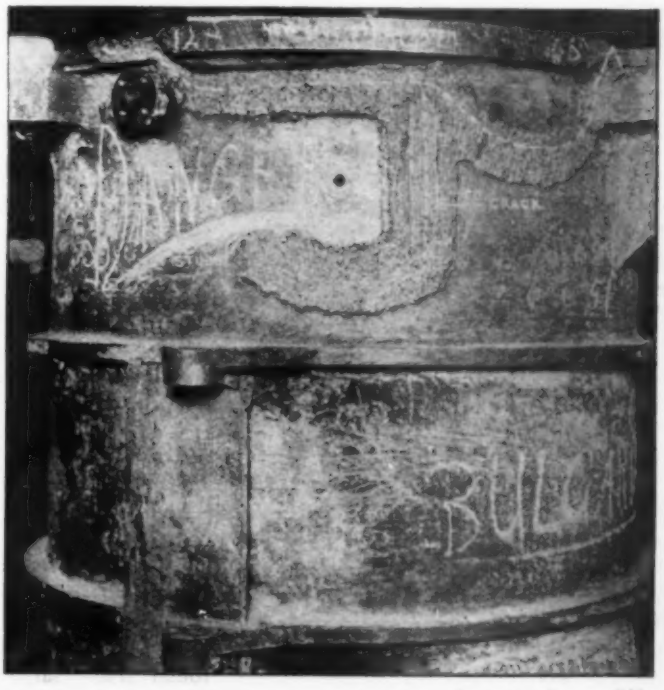


FIG. 9—REPAIRING BROKEN CASTING BY MEANS OF THE CALKING GROOVE METHOD USED BY THE NAVY DEPARTMENT FIG. 10—ANOTHER EXAMPLE OF WELDING BY THE CALKING GROOVE METHOD

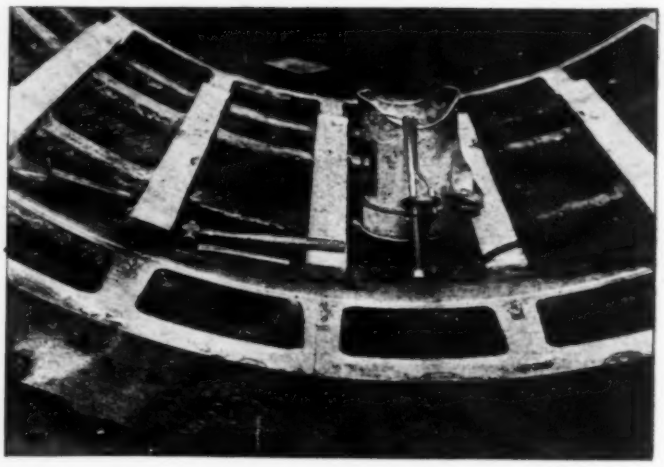


FIG. 11—THE FIRST ROUGHING CUT ON THIS CASTING DISCLOSED A SERIES OF BLOW HOLES ON THE UPPER FLANGE
FIG. 12—THE BLOW HOLES WERE EFFECTIVELY FILLED UP BY MEANS OF ARC-WELDING WITHOUT THE NECESSITY OF PREHEATING THE CASTING

A deposit similar to Fig. 1 was built up but as each layer of metal was completed it was thoroughly brushed and sand blasted. Standard tensile test pieces were cut from the deposited metal which tested as shown in Table III.

The fractures had the appearance of high grade partially-annealed low carbon cast steel. It is interesting to compare tests Nos. 5 and 6 with Nos. 1 and 2 and observe that while sand blasting the layers of metal did not appreciably affect the tensile strength, it did improve the ductility of the metal as evidenced by the per cent elongation and reduction of area. This is probably due to slag elimination to a greater degree. By close inspection of Fig. 1, one can see along the polished surface a scattering of relatively small imperfections. In the case of the sand blasted specimen, however, these are practically eliminated.

To give an idea of the physical properties of commercially welded cast steel, 10 steel bars, each 1 inch in diameter, were beveled and welded to obtain five welded specimens. The welded bars and also five bars of the original steel were turned into standard threaded test pieces similar to those shown at the right of Fig. 2. Table IV shows the results of these tests.

If we consider the average values of yield point and ultimate tensile strength, the welded specimens developed about 81.5 per cent of the ultimate tensile and 83.3 per cent of the yielding strength of the unwelded original steel castings.

Figs. 3, 4 and 5 show the various stages of a steel casting which was found defective due to large sand pockets. The entire defective part was cut out with the graphite electrode to fit the rectangular steel block which was then set in place and welded in position, using the graphite electrode process.

## Table II

### Results of Tensile Tests

| Test No. | Pounds per square inch Ult. strength | Yield point | Elas. limit | Per cent Elongation in 2 in. | Per cent Reduction in area |
|---|---|---|---|---|---|
| 1 | 58825 | 41000 | 40000 | 8.2 | 19.9 |
| 2 | 54650 | 35000 | 29000 | 6.5 | 13.4 |

### Compression Test

| Test No. | Pounds per square Inch Ultimate Strength | Elastic Limit |
|---|---|---|
| 3 | 95,400 | 34,500 |
| 4 | 92,450 | 29,450 |

Bending Test: Bar, ½-inch thick was bent through an angle of 100 degrees around a steel rod of 1 inch radius.
Shear Test: Two specimens failed at 46,200 and 44,600 pounds per square inch respectively.

## Table III

### Sand Blasting Specimen Improves Ductility

| Test No. | Pounds per square inch Ult. strength | Yield point | Elas. limit | Per cent Elongation in 2 in. | Per cent Reduction in area |
|---|---|---|---|---|---|
| 5 | 56,075 | 35,875 | 29,000 | 16 | 23.4 |
| 6 | 58,225 | | | 18 | 27.8 |

Where iron castings are to be repaired in the case of an extensive break, particularly if the grain is coarse, it is customary to use the studding method as illustrated by Figs. 6, 7 and 8. At one of the navy yards it has been the custom to provide a calking groove as shown by Figs. 9 and 10. Metal is deposited in the calking groove first, after which it is thoroughly peined down with a view of preventing steam leakage.

Figs. 11 and 12 show a large casting in which blowholes were discovered upon taking the first roughing cut. This type of welding application is particularly attractive and the actual saving in dollars, although large in itself, is often insignificant. The great gain, therefore, in many instances is made in time which with the cast constitutes the economic gain.

When the arc is used to melt part of a given piece of metal so that a portion of it can flow away or so that it becomes divided into two or more sections we speak of the fusing operation as that of cutting. The action is principally that of supplying sufficient localized heat to liquify the metal whereas in steel the gas process relies principally upon the union of the metal with oxygen (burning) forming slag which is carried out of the cut by the volume and velocity of the supplied gases.

The Figs. 13, 14 and 15 indicate the speed of cutting cast iron sections using about 600 amperes.

For cutting, the graphite electrode is usually used with current values of from 150 to 800 amperes, depending upon the class of work, speed desired

and capacity of the electrical equipment. For example a ½-inch thick, medium-steel plate can be cut at the rate of about 1 foot in 12 minutes using 150 amperes or about 1 foot in about 1¼ minutes using 400 amperes. Fig. 4 illustrates a good example of graphite electrode arc cutting.

Cutting can be done with the metallic electrode process, employing bare wire or heavily wrapped wire. To use the bare wire it is necessary to operate the electrode at a much higher current than for welding, which results in scattering the metal and making it difficult for the operator to maintain the arc. The wrapped electrode is undoubtedly the better suited for this work, especially if it is dipped in water frequently during the operation. In fact, it is possible to cut with this combination in cases where it is out of the question to use the graphite process. For example, during the war the British navy used water soaked, heavily wrapped electrodes for cutting holes 2 inches in diameter and several inches deep in armor plate on battleships for attaching rigging to protect against submarine torpedoes.

Insofar as the foundry is concerned, the electrical equipment required is essentially the same as for other industries, the chief differences probably being in the technique of operation. For example, it is probably safe to say that in most foundries the majority of the castings have relatively heavy sections of 1 inch or greater in thickness. Most of the welding work is such that each operator requires relatively high current values namely, from 175 up to and including 500 or 600 amperes. The question of current capacity, although important, must not be allowed to over-shadow other important features. In the first place do not be misled into thinking that any person can make a weld by using good welding equipment. It is impossible for an unskilled or an untrained operative to make good welds consistently even with the most satisfactory equipment. Likewise a skillful, trained welder will be able to make reasonably good welds under proper conditions, with practically any equipment available. However, he will observe after working with various welding outfits that it is easier for him to make good welds consistently, at greater speed and less expenditure of nervous energy with some equipment than with others. To provide for this condition the design and construction of the electrical equipment must be such that the following characteristics prevail at the arc:

1. Arc must easy to start.
2. Arc must be easy to maintain.
3. Arc must produce sufficiently deep fusion or penetration in surface of casting or parts to be welded.
4. Current through the arc should remain practically constant at any value of arc voltage drop between limits of 20 to 0 volts.

Undoubtedly the best way to determine the existence of the first two characteristics is to actually work with various equipments under identical conditions, using the metallic electrode process. However, these characteristics can be illustrated by means of the oscillograph,

**Table V**

**Current Values Under Varied Conditions**

| No. of generators connected in parallel | Range of current metal electrode | Values obtainable graphite electrode |
|---|---|---|
| 2 | 150-430 | 100-300 |
| 3 | 225-645 | 150-450 |
| 4 | 300-860 | 200-600 |

**Table IV**

**Comparison of Welded and Unwelded Specimens**

| Bar No. | Pounds per Square Inch Ultimate Strength | Yield Point | Per Cent Elongation in 2 inches | Per Cent Reduction in area |
|---|---|---|---|---|
| *Welded Specimens* | | | | |
| 1 | 57,100 | 30,600 | 10.0 | 21.8 |
| 2 | 54,200 | 29,700 | 7.0 | 14.7 |
| 3 | 45,000 | 27,600 | 5.0 | 14.7 |
| 4 | 51,200 | 30,700 | 8.0 | 14.7 |
| 5 | 55,700 | 32,200 | 9.0 | 18.6 |
| Average | 52,640 | 30,160 | | |
| *Original Non-Welded Specimens* | | | | |
| 6 | 63,000 | 35,800 | 36.0 | 56.9 |
| 7 | 64,000 | 37,300 | 35.5 | 58.3 |
| 8 | 61,400 | 35,800 | 36.0 | 58.3 |
| 9 | 63,000 | 36,300 | 36.0 | 57.7 |
| 10 | 61,400 | 35,800 | 31.0 | 58.3 |
| Average | 64,560 | 36,200 | | |

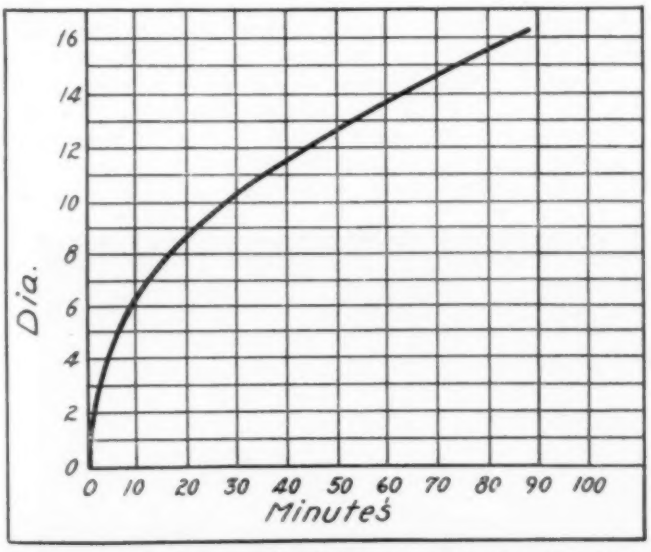



FIG. 13—RATE OF CUTTING CIRCULAR SECTION OF CAST IRON BY THE ARC PROCESS

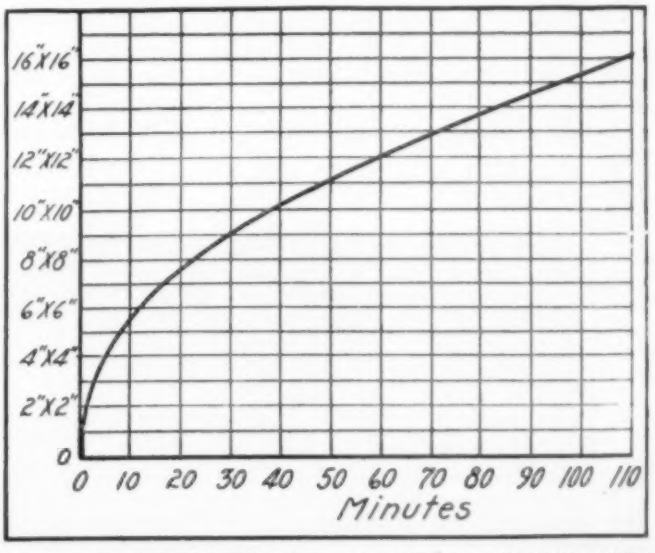



FIG. 14—RATE OF CUTTING CAST IRON BLOCKS BY THE ARC PROCESS

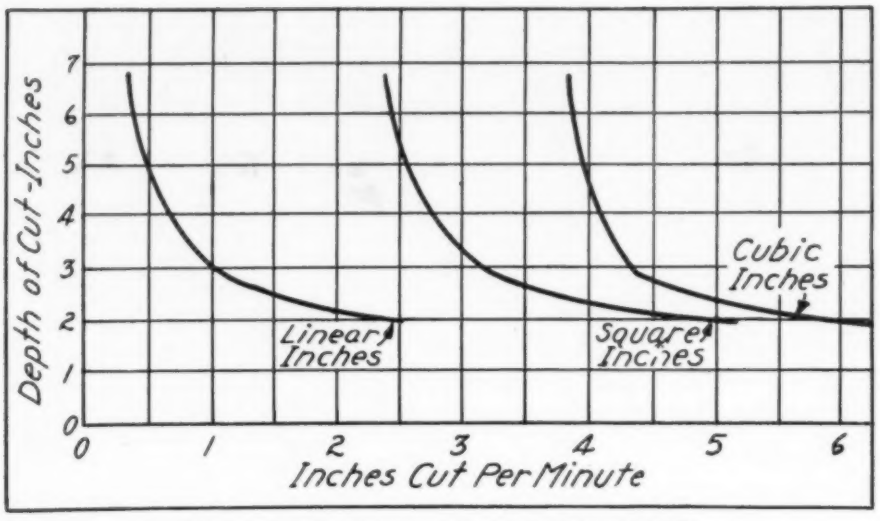



FIG. 15—RATE OF CUTTING CAST IRON PLATES

as will be clearly pointed out later.

Arc welding outfits are available in single-operator and multiple-operator types. The former type is illustrated by Fig. 16, the scheme of connections

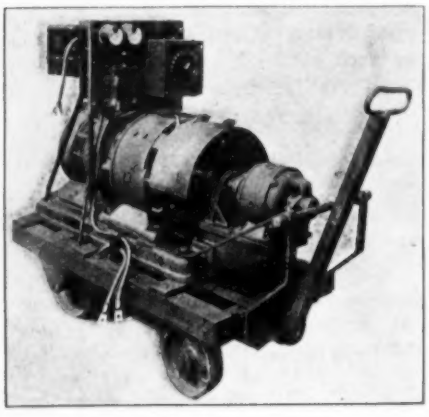


FIG. 16—A REPRESENTATIVE SINGLE OPERATOR TYPE ARC WELDING OUTFIT

is shown in Fig. 20. This equipment is a new departure in the field of one-man outfits. It is not within the province of this paper to discuss fully the design and characteristic of this machine since this has been done very thoroughly by two papers presented at the annual convention of the American Institute of Electrical Engineers at White Sulphur Springs, W. Va. June 29-July 2, 1920. It is sufficient therefore to point out that the unique design which interconnects the 125-volt constant voltage exciter circuit with the variable-voltage constant-current generator circuit, gives the arc all the stabilized characteristics of the multiple operator 60-volt constant potential equipments, without requiring any stabilizing resistance in the welding circuit, and with a nominal external reactance or stabilizer coil.

This machine delivers welding current in 20 steps between the limits of 50 and 215 amperes at 20 volts for metal electrode welding and delivers 150 amperes at 35 volts for graphite electrode welding. For work requiring higher current values, two or more machines can be easily and quickly operated together in parallel by simply connecting the positive or ground cables of the various generators to the work and by connecting the negative or electrode cables to a single electrode holder. This then provides for current values as indicated by Table V.

This type of equipment is therefore adapted to small foundries which require an appreciable amount of metallic electrode work as compared with graphite electrode work. In part, for such foundries two medium-capacity single-operator machines, for example, will be more flexible and a better investment than a single high capacity unit because the two machines can be operated independently for two operators, whereas, only one operator can work with a high capacity single operator unit.

For building up pads on castings, especially on vertical surfaces, the metallic electrode process is the better. Many operators build up such pads somewhat over size and then trim them down with the arc using the graphite electrode. If the pad is not too large it can be brought to a temperature above a red heat so that it can be hammered vigorously, thereby improving the grain structure and external surface appearance of the deposited metal.

For filling in large cavities such as blowholes, sand holes, etc., in castings the metallic electrode process of employing large diameter electrodes and high current values of 300 to 450 amperes, can be used or the graphite electrode process using 300 to 600 amperes can be used. However, the author wishes to state that in the hands of the average

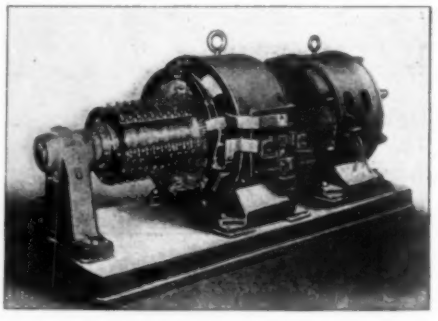


FIG. 17—A TYPICAL MULTIPLE-OPERATOR MOTOR GENERATOR

operator the use of current above 200 amperes with the metallic electrode or the graphite electrode process should be limited to welding work where strength is secondary to increased speed and decreased cost of performing the work.

The multiple operator 60-volt constant potential equipment has been available for so many years and has proved to be so satisfactory and reliable, particularly for group installations in large foundries, that it is unnecessary to dwell at length upon this type of equipment. The significance of the term

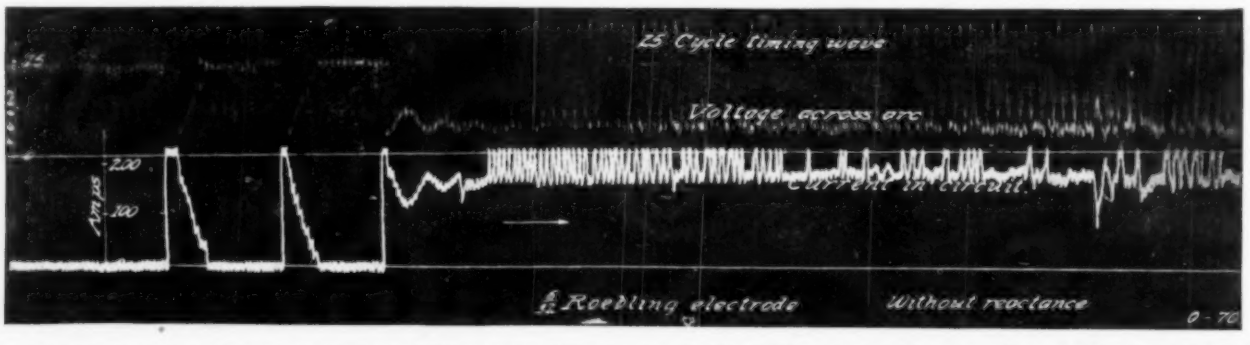



FIG. 18—WITH NO REACTOR IN THE CIRCUIT THE OPERATOR STRUCK HIS ARC THREE TIMES BEFORE CATCHING

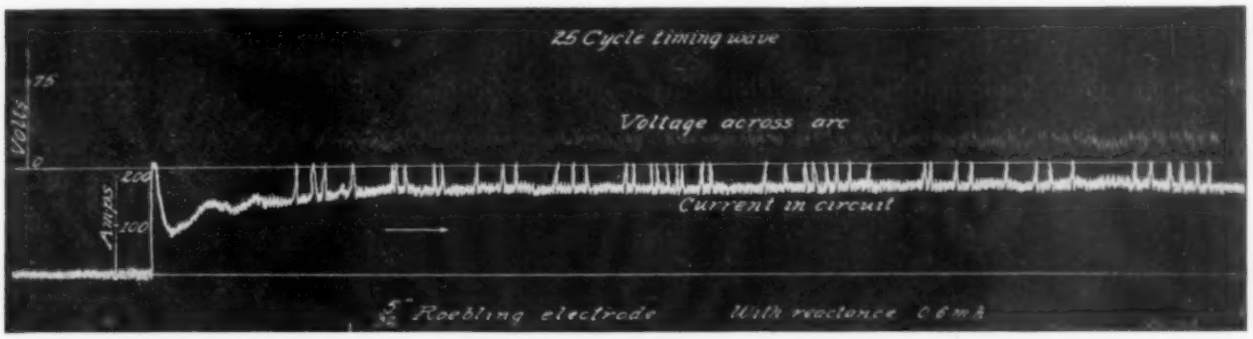



FIG. 19—WITH A REACTOR IN THE CIRCUIT THE OPERATOR CAUGHT THE ARC ON THE FIRST ATTEMPT

"multiple operator" is that the generating equipment and control apparatus for the welding circuits are designed so that two or more operators can draw welding currents of different values from an individual generator without any arc interference. The multiple operator equipment is particularly adapted to foundry installations where a number of operators will work close together because the installation and investment cost will be less than for the required number of single operator equipments.

Multiple operator motor-generators are available in capacities of approximately 300, 500, 750 and 1000 amperes. A typical unit is shown in Fig. 17.

In connection with this type of equipment many purchasers have failed to properly appreciate the use of a relative small reactor in each metallic electrode welding circuit in addition to the resistance to facilitate striking and holding the arc. The latter feature is most noticeable when the operator is welding on poor material containing foreign matter such as occluded gas or grease, a high percentage of carbon, or other gas-forming elements, which will have a very decided tendency to blow out the arc.

The reactor is simply an inductive coil which delays the rate at which the current builds up through the electrode when it is touched against the work incident to striking the arc. This minimizes the tendency for the metallic electrode to stick or "freeze" to the work. The reactor also stores electromagnetic energy which counteracts unstabilizing influences such as mentioned above. In fact, the reactor gives the multiple operator welding circuit the desirable characteristics of the interconnected single operator equipment. To illustrate the assistance in striking the arc, oscillograms shown in Figs. 18 and 19, are submitted. In each of these cases the welding circuit was adjusted to deliver about 175 amperes, 20 volts at the arc and 60 volts at the generator. In the former case, with no reactor in the circuit, the operator struck his arc three times before catching it. In the latter case with the reactor in the circuit the arc was caught at the first attempt. This piece of apparatus is obviously a very desirable asset particularly for circuits to be used for training new operators. Obviously it also will conserve time and nervous energy of a skilled operator which should result in a larger and better daily welding production.

## Equips for Malleable Jobbing Work

(*Concluded from page* 175)

with a space after each in which to write *yes* or *no* according to whether these operations should be carried out by the Temple company. Then in a space near the center of the sheet a sketch is made of the casting to enable the clerks in the hard-iron room and the shipping department, to each of whom a copy of the sheet is sent, to identify the castings as they come along. One or more dimensions, as well as the pattern number are given on the sketch. Spaces are reserved at the bottom for the number of pieces to be made and the pattern number underneath which are blank columns in which the number of pieces made with the date may be recorded. The clerk in the hard-iron room secures the data from a foundry production sheet which is a daily record showing the name of each molder, number of molds made, number of pieces to mold, pattern number, name of the owner of the pattern, weight of a single casting, number of bad pieces, weight of bad castings, number of good pieces, number of good molds, weight of good castings and the number of molds not poured. The information on this sheet besides furnishing a basis for recording the number of castings made also serves to show the losses which are investigated if they reach undue proportions.

As has been said, the number of castings made each day is tallied on a loose leaf sheet by the clerk in the hard-iron room. The sketch on the sheet serves to identify it with the casting as a pattern number would be hard to locate unless all sheets were arranged consecutively according to pattern number. The ease with which the desired sheet is found is illustrated in Fig. 9, showing a sheet with a casting sketched on it. By constant use of the book, the clerk knows closely the location of any sheet and it is not difficult for him to turn to it. After the order is completed, the clerk in the hard-iron room sends his sheet to the shipping room. The clerk there, who has kept a record of the castings received by him each day on his sheet, knows when to look for the castings which will complete the order after he receives the sheet from the hard-iron room.

## Addresses Foundrymen on Building Design

Attended by approximately 100 members the monthly meeting of the Pittsburgh Foundrymen's association was held at the Hotel Chatham Monday evening, Feb. 21, preceded by the usual dinner. In his interesting address on "Modern Foundry Buildings," which was illustrated by stereopticon slides, O. D. Conover, assistant chief engineer of the Austin Co., Cleveland, described various types of modern foundry buildings and showed the methods pursued in their construction and erection.

## Opens Milwaukee Office

Frederic B. Stevens, Detroit, recently has opened an office and warehouse at 1350 National Ave., Milwaukee. This warehouse has been stocked with a complete line of foundry facing, polishing and buffing compositions, etc. A. M. Weis is in charge of the Milwaukee office.

The Blue Ridge Talc Co., Inc., Henry, Va., recently has installed a 4-roller Raymond mill to produce an extremely fine talc for paints in addition to the regular line of red and yellow facing talc.

# British Shop Operates American Machines

BY H. COLE ESTEP
(*European Manager, THE FOUNDRY*)

FIG. 1 — ADJUSTABLE HAND-RAMMING PATTERN-DRAWING MACHINES OF BRITISH MANUFACTURE

AN INTERESTING installation of American molding machines has recently been made at the plant of Wolseley Motors, Ltd., Birmingham, England. Wolseley Motors is one of the subsidiaries of what was formerly the great armament firm of Vickers, Ltd., which since the war has developed an extensive line of manufacture ranging all the way from merchant ships and large marine engines to sewing machines. The automobile-making activities of Vickers, Ltd., are handled by the Wolseley company.

Since the plant at Birmingham was taken over by the Vickers interests it has been greatly improved and extended, especially in the foundry where quantity production methods have been inaugurated. Fig. 2 shows the special rig which has been devised for molding heavy crank cases for the Wolseley car. This is one of the largest aluminum castings used in any British car. It houses the flywheel, timing gears, etc., as well as the cranks, and incorporates the side struts which fasten the engine to the frame of the car. It weights about 50 pounds. The job is handled by a large roll-over, jar-ramming machine of the shockless type, built by the Tabor Mfg. Co., Philadelphia. The machine was furnished by the Tabor company's British representatives, Macnab & Co., Southampton Row, London.

The molds are handled on hand push trucks which run on a circular track about 50 feet in diameter as shown clearly in Fig. 2. The gage of the track is about 30 inches. Wooden flasks are employed. The machine is so placed that it rolls the flask over directly onto the waiting truck. The

FIG. 2—CONTINUOUS MOLDING OF ALUMINUM CRANKCASES USING A ROLLOVER JAR-RAMMING MACHINE

# THE FOUNDRY DATA SHEET, MARCH 1, 1921

**Payment will be made for all contributions on foundry and pattern shop practice suitable for publication**


## NONFERROUS ETCHING SOLUTIONS

*By Ernest J. Davis*

| REAGENT | ALLOY MOST SUITED FOR | STRUCTURE | CONSTITUENT | REMARKS |
|---|---|---|---|---|
| Hydrochloric acid | White bearing alloys high in tin | General structure of tin base bearing metals | General structure | Requires rather long immersion to give contrasts for photography |
| Nitric acid | Phosphor-coppers copper-silver alloys | Eutectic and solid solutions | General structure | Gives very good contrasts for photography |
| Nitric acid | Brass | General structure | Grain boundaries and crystal structure | Useful in control of heat treatment of brass |
| Nitric acid | White bearing alloys generally | Intermetallic compounds, eutectic and solid solutions | General structure | Gives good contrasts for photography |
| Aqua Regia | Alloys of gold and platinum | Solid solutions, eutectics | General structure | |
| Aqua Regia | Gold alloys | General structure | General structure | |
| Chromic acid | Alloys rich in lead | Eutectic | General structure | Gives well defined eutectic structure |
| Ammonia | Alloys of copper and zinc | Alpha solid solution well distinguished from beta solid solution | General structure and grain boundaries | Rather difficult to control but gives good results with experience |
| Ammonia and Hydrogen peroxide | Alloys of copper and zinc | Alpha solid solution well distinguished from beta solid solution | General structure | Does not give such good results as above |
| Ammonium persulphate | Alloys of copper and zinc also copper and tin | Solid solutions | General structure; crystal structure | Not so good as $NH_4OH$ |
| Ammonia and Ammonium persulphate | Alloys of copper and zinc | Solid solutions | General structure | Good when in right proportions, a fresh solution used each time |
| Ammonia and Ammonium persulphate | Alloys of copper and zinc, manganese bronze, etc | Morse | Crystal structure and grain boundaries | |


*(Concluded on Data Sheet No. 372)*




## NONFERROUS ETCHING SOLUTIONS

*By Ernest J. Davis*


*(Concluded from Data Sheet No. 371)*


| REAGENT | ALLOY MOST SUITED FOR | STRUCTURE | CONSTITUENT | REMARKS |
|---|---|---|---|---|
| Acid ferric chloride | Alloys of copper-zinc phosphor bronzes, manganese bronze, etc. | Solids solutions intermetallic compounds | General structure | Gives good contrasts for photography |
| Caustic soda | Aluminum alloys rich in zinc | General structure | General structure | Black deposit may be removed by immersion in chromic acid |
| Caustic soda | Aluminum-nickel alloys | General structure | Identification of $NiAl_3$ which is colored brown | $NiAl_3$ is distinguished from $CuAl_2$ which is not attacked |
| Caustic soda | Aluminum | Crystalline structure and impurities | Grain boundaries | The alcoholic solution does not pit the specimen. |
| Caustic potash | Aluminum alloys | General structure | General structure | Deposit may be removed by immersion in chromic acid |
| Hydrofluoric acid | Aluminum copper | Crystalline structure<br>General structure | Grain boundaries | Distinguishes between copper oxide and sulphide the latter is unattacked |
| Hydrofluoric acid | Copper | Distinguishes between copper oxide and copper sulphide. The latter is unaffected | | Gives better results than above |
| Nitric acid | Aluminum-magnesium alloys | General structure | Magnesium constituents colored brown | |
| Copper Ammonium chloride | Copper alloys rich in copper | Crystal structure | Grain boundaries | |
| Bromine water | Alloys rich in copper | Crystal structure | | The surface may be cleaned with ammonia if necessary |
| Iodine | Alloys rich in zinc or cadmium | General structure | | |
| Silver nitrate | Alloys of lead, tin or bismuth | General structure | | The deposit that forms on the surface is easily washed off |
| Heat tinting | Copper and copper alloys | | Phosphides, etc. | |



Note—This sheet may be cut into two sections, 5 x 7 inches, and may be readily bound in note book form.

operator's station where all the control levers are located, is at the right as shown in the illustration. After leaving the machine, the molds pass around the circular track to the core-setting station where the heavy cores forming the interior of the casting are set in place. This operation is shown at the left in Fig. 2. The copes, which are merely flat covers, are put on next and the complete mold then passes on to the pouring station. From here it proceeds to the shaking-out floor where the casting is shaken out of the sand and sent to the cleaning room, while the empty flasks, truck, sand, etc., are returned to the molding station

A large amount of the cylinder molding at the Wolseley plant is done on standard rollover drop machines about 14 x 24 inches in size are employed. Two castings are made in each mold, heavy dry-sand cores being used, as shown in Fig. 1. The molding machines are of the large type with turnover attachment and 6-inch draft.

## Recommends Method for Reclaiming Malleable

A recent issue of *Autogenous Welding*, published by the Davis-Bournonville Co., Jersey City, N. J., contains some interesting observations on welding malleable castings. The article explains that malleable cast iron is white iron melted in reverberatory furnaces, cast and annealed or malleablized by packing in iron boxes and heating. On account of hardness and brittleness of castings in this state they must be carefully preheated, and cooled after welding. When white castings are repaired, white cast iron filling rod should be used. The subsequent process will then convert the new metal into malleable iron along with the body of the casting.

In some malleable iron foundries the parts are reclaimed after having been packed and annealed, using for the purpose malleable iron filling rod. No definite rule can be laid down for this procedure as the advisability of reclaiming will depend upon the nature of the defective part of the piece and the position of the defect with relation to the parts subject to greatest stress. In general, of course, it is not considered good practice for the reason that the

FIG. 3—BATTERY OF PLAIN ROLLOVER, DROP MACHINES USED FOR MOLDING CYLINDERS

furnished by Henry E. Pridmore, Chicago. A battery of these machines engaged in cylinder molding is shown in Fig. 3. The machines are arranged in a row against the walls, which are painted white, and the molds are set on the floor in the ordinary manner. Metal patterns and pattern plates are employed and a shelf is provided back of the machine for storing surplus patterns which are in current use.

A large number of British molding machines also are employed in the Wolseley foundry. Fig. 1 shows a pair of adjustable hand-ramming machines built by the Adaptable Moulding Machine Co., Stanhope street, Birmingham, England. These machines are used for molding rear-axle housings of the worm-drive type used on commercial vehicles. Cast-iron flasks

Defective castings cost the malleable foundry more than the gray iron foundry, and thus reclamation of malleable castings is very desirable. Practice differs with the manufacturer and the customer.

The simplest and most effective process for reclaiming malleable castings, the article states, is to braze the defective parts with tobin bronze, thereby insuring ample strength and reliability for general purposes. But unfortunately, many customers would object to such reclaimed castings, as the bronze used is quite apparent and it is obvious that the castings must have been originally defective.

The most satisfactory method of reclaiming malleable castings is to carefully inspect the white iron castings for defects and to reclaim them before putting through the malleablizing process. malleable iron is deteriorated by the heat of the torch flame and reconverted into an inferior grade of cast iron.

Hence, the situation with respect to reclaiming of malleable castings is substantially as follows:

1.—Malleable foundries may reclaim castings in the white iron state by using white iron filling rod, provided the castings are carefully preheated and cooled to equalize the strain.

2.—Malleable castings may be reclaimed by brazing, using tobin bronze rod. The bronze produces a strong and effective repair but is objectionable to some customers because of the obvious repaired defect.

3.—Castings may be repaired after the malleablizing process using malleable iron or steel filler rod, but only at the cost of reducing the strength of the casting.

# Analyze Loss in Aluminum Shops-VI

## Reason for Casting Losses in Production Considered—Tendency Is Toward the Use of Green-Sand Cores Wherever Possible — Melting Methods Studied—Zinc Chloride Chief Flux Used

BY ROBERT J. ANDERSON

A GREAT variety of castings is made in the aluminum foundries of this country—a greater variety possibly than the average foundryman may realize. This bulk of the domestic production goes into automotive construction, in the manufacture of gasoline motors for passenger cars, motor trucks, and for aircrafts. The domestic cooking-utensil industry and the vacuum-cleaner industry also consume large amounts of aluminum-alloy castings. Thus for motor work, typical castings made are pistons, crankcases, oil pans, transmission housings, magneto brackets, steering-wheel spiders, intake and exhaust manifolds, camshaft housings, pump housings, motor foot boards, steering-gear cases, timing-gear cases, rocker arms, carburetor bodies, radiator holders, hub caps, ignition and starter housings, clutch cones, cylinder covers, gear covers, transmission and differential housing covers, as well as automobile bodies, wheels, cowling and dash parts, and miscellaneous small castings. Tea kettles, teakettle and coffee-pot spouts, griddles, waffle molds, and frying pans are among the cooking utensils which are cast of aluminum alloys, usually aluminum-copper alloys. The parts of vacuum cleaners which are usually made of aluminum alloys are the motor housing, nozzle, motor cap, fan, handle grip, bag coupling, brush housing, name plate, suction coupling, blower coupling, and miscellaneous tools such as upholstering attachments. Some aluminum-alloy castings also go into the construction of electrical washing machines made by the same companies which manufacture vacuum cleaners. Other kinds of aluminum-alloy castings made in the United States include cast vessels for chemical industry; pressure cookers; hat blocks; ornamental castings; naval castings such as sight-work parts, instrument parts, droop-meter castings, gun dotters, loading-tray slides, nitrating pot covers, castings for electric-ship work, castings for ship repair, radio equipment and aeronautic instruments; electrical appliances; hand wheels for screw machines and other metal-working machinery; parts for electric furnaces; dip-basket handles; valve parts; surveying compasses; balance beams; small parts for engineering, scientific and surveying instruments; lamps; printing blocks; small (fractional horsepower) electric-motor housings; parts for electrical tools; scale trimmings; pulleys; nozzles for cement guns; street car fare boxes; machinery parts, shields for wireless apparatus; motion picture machine parts, housings for massage vibrators; automobile tire-mold cores; thermometer parts; time-clock parts; engraving-machine parts; etc. Aluminum-alloy match plates, patterns, snap flasks, and mold boxes are also now used largely in founding.

### Table XV

### Total Output Aluminum-Alloy Sand Castings in 1919

| Kind of castings | [a]Pounds | per cent |
|---|---|---|
| [b]Automotive | 75,000,000 | 92.59 |
| Vacuum-cleaner | 3,500,000 | 4.32 |
| Cooking-utensil | 1,480,000 | 1.83 |
| Small electric motor housings and cases | 250,000 | .31 |
| Patterns and flasks | 200,000 | .25 |
| Scale trimmings | 100,000 | .12 |
| Machinery parts | 50,000 | .06 |
| Ornamental | 40,000 | .05 |
| Scientific and other instruments | 30,000 | .04 |
| Miscellaneous, not classified | 350,000 | .43 |
| Total | 81,000,000 | 100.00 |

[a] On the basis of reported figures and from other sources.
[b] Including all kinds of castings for the motor industry—crankcases, oil pans, camshaft housings, manifolds, carburetor bodies, carriers, brackets, etc.

Table XV shows the total annual amounts and the average percentage of the total of the various kinds of aluminum-alloy castings made in the United States in 1919. Of course, the annual quantity of aluminum used for various kinds of castings differs from year to year, depending upon industrial and other conditions. In 1918, practically the entire production of castings was for air craft and motor cars, while in 1919 the amount going into motor cars was exceptionally large because of the prosperity in the motor industry and the continued tendency toward the use of aluminum alloys in automotive work.

### Table XVI

### Castings Yielding High and Low Scrap Losses

| Reply | Mentioned as high | Casting loss, per cent | Mentioned as low | Casting loss, per cent |
|---|---|---|---|---|
| 114 | Machinery and instrument parts | 75 | Street car fare boxes | 5 |
| 147 | Water pump bodies | 25 | Steering-gear cases and foot-boards | 2 |
| 461 | Pump parts | 25 | Ornamental | 15 |
| 142 | Pistons | 25 | Nozzle bodies | .. |
| 496 | Light castings | 23 | Castings of uniform sections | 2 |
| 111 | Oil pans | 20 | Transmission case | 8 |
| 472 | Vacuum-cleaner nozzles | 11 | Bag couplings | 5 |
| 400 | Crankcases | 10 | Crankcases | 3 |
| 483 | Cored castings | 6 | ..... | 1 |
| 343 | Pulleys | 6 | Electrical tool parts | 1 |
| 204 | Match plates | 5 | Crankcases | .. |
| 248 | Motor car castings | 5 | Electrical tool parts | 2 |
| 222 | Pattern castings | 5 | Ornamental | 0.5 |
| 501 | Small chunky castings | 5 | Light castings of uniform shape | 0 |
| 490 | Crankcases | 4 | ..... | .. |
| 438 | Light castings | 3 | Heavy | 1 |
| 333 | Light, open castings | 2 | Heavy, solid castings | 1 |
| 293 | Windshield frames | 2 | ..... | .. |

Castings made in aluminum-alloys vary in weight from a few ounces or less up to about 100 pounds or heavier. The weight of the lightest sand casting reported was 0.017 pound (0.272 ounce),

## Table XVII

## Reasons for Losses in Production of Aluminum-Alloy Sand Castings

| Reply Number | Most serious difficulty considered to be | Average loss per cent | CAUSES FOR LOSSES, PER CENT: Blow-holes | Cracks | Shrunk | Porosity | Over heated melts | Faulty ramming | Wrong pouring tempera-tures | Poured short | Unsound | Inferior Aluminum ingot | Molding causes, not classified |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 102 | Cracks | 5.0 | 1.0 | 4.0 | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| 114 | Shrinkage | 15.0 | 1.0 | .. | 10.0 | 4.0 | .. | .. | .. | .. | .. | .. | .. |
| 142 | Do not know | 25.0 | 2.0 | 15.0 | 5.0 | 3.0 | .. | .. | .. | .. | .. | .. | .. |
| 147 | Molding and melting | 10.0 | .. | .. | .. | .. | 7.0 | 3.0 | .. | .. | .. | .. | .. |
| 153 | Do not know | 9.0 | .. | 1.0 | 2.0 | 1.0 | .. | 2.0 | 2.0 | 1.0 | 1.0 | .. | .. |
| 191 | Shrinkage | 10.0 | .. | .. | .. | .. | .. | .. | 5.0 | .. | 5.0 | .. | .. |
| 204 | Ramming | 5.0 | .. | .. | .. | .. | .. | 2.5 | 2.5 | .. | .. | .. | .. |
| 233 | Shrinkage and porosity | 3.0 | .. | .. | .. | 1.0 | .. | 1.0 | .. | .. | 1.0 | .. | .. |
| 248 | Inferior aluminum ingot | 2.0 | .. | .. | .. | .. | .. | .. | .. | .. | .. | 2.0 | .. |
| 279 | Shrinkage | 5.0 | .. | .. | 2.0 | .. | .. | 1.0 | 2.0 | .. | .. | .. | .. |
| 287 | Pouring temperatures | 4.0 | 0.5 | 0.5 | 0.5 | .. | .. | .. | .. | 0.5 | .. | .. | 2.0 |
| 293 | Shrinkage | 2.0 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 2.0 |
| 333 | Shrinkage | 1.0 | .. | .. | 1.0 | .. | .. | .. | .. | .. | .. | .. | .. |
| 343 | Porosity | 3.0 | .. | 1.0 | .. | .. | .. | .. | .. | .. | .. | .. | 2.0 |
| 407 | Pouring temperatures | 4.375 | 0.125 | .. | 0.125 | 0.125 | .. | .. | 3.0 | 0.5 | 0.5 | .. | .. |
| 438 | Pouring temperatures | 5.0 | .. | .. | .. | .. | 1.0 | .. | 2.0 | 2.0 | .. | .. | .. |
| 442 | Shrinkage | 5.0 | .. | .. | .. | .. | 2.0 | .. | .. | .. | .. | .. | 3.0 |
| 455 | Inferior aluminum ingot | 3.0 | .. | .. | .. | 1.0 | .. | .. | .. | .. | .. | 1.0 | 1.0 |
| 472 | Molding | 8.0 | 1.0 | .. | .. | 0.25 | .. | .. | 2.0 | 0.25 | .. | .. | 4.25 |
| 475 | Cracks and pouring temperatures | 4.0 | 0.25 | 0.95 | 0.75 | 0.25 | 0.25 | .. | 1.0 | 0.10 | .. | .. | 0.45 |
| 477 | Ramming and molding | 9.0 | .. | .. | 3.0 | .. | .. | .. | 1.0 | .. | .. | 3.0 | 2.0 |
| 496 | Shrinkage | 4.0 | 1.0 | .. | .. | 3.0 | .. | .. | .. | .. | .. | .. | .. |
| 497 | Molding | 10.0 | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | 10.0 |
| 498 | Ramming and pouring temperatures | 10.0 | .. | 2.0 | .. | .. | 2.0 | .. | 4.0 | .. | .. | .. | 2.0 |
| Averages | | 6.724 | 0.286 | 1.019 | 1.016 | 0.568 | 0.552 | 0.313 | 1.021 | 0.181 | 0.313 | 0.25 | 1.196 |

and many kinds of small castings weighing from a quarter to two ounces are made. The weight of the heaviest casting reported was 600 pounds; crankcases weigh from 40 to 100 pounds, depending upon the size and design. The relation of casting losses to the weight of the casting poured is not determinate because such factors as design, molding, and the alloy used, enter into the question.

*Casting Losses in Production*

Information as to the actual casting losses in the production of aluminum-alloy sand castings was sought in the questionnaire. Data furnished regarding the average percentage of castings rejected for specific reasons varied widely, depending upon the type of castings made, the rigidity of the specifications, the reliability and accuracy of the records, and other factors. Taking the actual figures reported, losses were stated to range from zero to 75 per cent of the castings poured. On the same basis, the average losses reported varied from none to 15 per cent, with an indicated mean of 5.21 per cent. The high losses varied from 2 to 75 per cent, with an indicated average of 14 per cent; and the low losses ranged from 0.0 to 15 per cent, with an indicated mean of 2.6 per cent. Table X gives the high, low and average losses reported in the production of various kinds of castings. Table XVI gives the high and low losses for a number of types of castings as reported.

Figures for the average percentage of castings returned from the machine-shop to the foundry are of little value unless the cause for scrapping the casting is determined. Usually, itemized data in regard to this are lacking. A casting may be scrapped in the machine shop for either of two reasons; that is, because of defects in the casting such as warpage or lack of sufficient finishing stock, or because of machining errors. The latter has no relation to foundry casting losses, and in the former, proper inspection will keep out of the machine shop castings which cannot be machined because of inherent faults in the casting. Figures reported to the bureau for the average percentage of machine shop scrap varied from 0.0 to 4 per cent, with an indicated average of 1.57 per cent. In the production of castings, for the Liberty motor, it was found that about 1 per cent of the castings sent to the machine shop had to be returned to the foundry because of casting defects. This figure refers mainly to crankcases and oil pans. An average figure for the percentage of machine shop scrap caused by actual casting de-

## Table XVIII

## Causes for Defective Castings in a Large Foundry

| | Causes for losses | Per cent of castings scrapped | Totals |
|---|---|---|---|
| Due to cores | (Cut through | 0.75 | |
| | (Crushed | 0.21 | |
| | (Broken | 0.57 | |
| | (Set wrong or shift | 0.41 | |
| | (Blows | 0.12 | |
| | (Miscellaneous | 0.24 | |
| Total | | 2.30 | 2.30 |
| Due to molding | (Blows | 0.24 | |
| | (Drops or sand holes | 1.83 | |
| | (Chill blow | 0.10 | |
| | (Hard and soft ramming | 0.47 | |
| | (Wet sand | 0.15 | |
| | (Chill drop | 0.15 | |
| | (Miscellaneous | 0.26 | |
| Total | | 3.22 | 3.22 |
| Due to other causes | (Cracked | 2.27 | |
| | (Cracked in welding | 0.36 | |
| | (Broken in handling | 1.76 | |
| | (Broken in welding | 0.10 | |
| | (Broken in chipping | 0.34 | |
| | (Broken in knocking out cores | 0.17 | |
| | (Broken in trucking | 0.02 | |
| | (Warped or not to gauge | 0.46 | |
| | (Poured short | 0.17 | |
| | (Mis-run or run-out | 2.18 | |
| | (Faulty metal | 0.34 | |
| | (Miscellaneous causes, not classified | 0.23 | |
| Total | | 8.40 | 8.40 |
| | Grand Total | | 13.92 |

## Table XIX

## Various Fluxes Used per Average Heat

| Material used | Amount of material, ounces | Added to heat, weighing pounds | Per cent, by weight |
|---|---|---|---|
| Zinc chloride | 4.0 | 50 | 0.50 |
| Zinc chloride | 2.0 | 75 | 0.17 |
| Zinc chloride | 1.0 | 40 | 0.16 |
| Zinc chloride | 1.0 | 60 | 0.10 |
| Zinc chloride | 1.5 | 100 | 0.09 |
| Zinc chloride | 1.0 | 100 | 0.06 |
| Zinc chloride | 2.0 | 250 | 0.05 |
| Zinc chloride | 1.0 | 200 | 0.31 |
| Zinc chloride | 0.125 | 50 | 0.02 |
| Zinc chloride | teaspoonsful | 200 | .... |
| Zinc chloride | teaspoonful | 60 | .... |
| Sodium chloride | 5.0 | 60 | 0.52 |
| Sodium chloride | 4.0 | 50 | 0.50 |
| Sodium chloride | 2.0 | 60 | 0.20 |
| Ammonium chloride | 0.66 | 33 | 0.13 |
| Silicon metal | 2.0 | 120 | 0.10 |
| Borax | 0.02 | 60 | 0.002 |

a. Reported in replies to questionnaire.
b. No value, if not positively harmful.

fects may be placed conservatively at 0.8 per cent for all kinds of castings. Necessarily, it may be much lower than this for some types of castings, but the indicated mean value may be taken at 0.8 per cent.

The replies furnished as reasons for casting losses in the questionnaire were exceedingly unsatisfactory in the main, indicating that records are not kept in any considerable detail, other than in the largest plants. Table XVIII is an analysis of the reasons for casting losses in a foundry making a variety of automotive and other castings, based on an annual output of 12,000,000 pounds of finished castings and an average casting loss of 13.92 per cent. In analyzing the figures given in Table XVIII, it is interesting to observe that the greatest individual loss is traceable to cracks. This defect is one of the most difficult to eliminate because it may be due to one of several, or a combination of causes.

Cope drops, causing sand holes, and sand left in the molds through improper cleaning, account for 1.83 per cent of the rejections. Mis-runs and runouts resulted in a loss of 2.18 per cent. Breakage in handling is 1.76 per cent, a high figure, but breakage is normally high in large foundries when the castings are handled by cranes, and particularly if the production is rushed. In the classification of losses according to groups, as given by the analysis, 2.30 per cent was scrapped because of core troubles such as cuts through, crushes, broken cores, core blows, cores

## Table XX

## Melting Practice As Related to Casting Losses

| | MELTING METHODS | | | AVERAGE PERCENTAGE OF MATERIALS CHARGED PER HEAT | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Reply Number | Kind of furnace | Kind of fuel used | Average weight of heat charged, pounds | Primary aluminum ingot | Copper | 50-50 rich alloy | Zinc | Secondary aluminum ingot | Primary Aluminum alloy ingot | Secondary aluminum alloy ingot | Foundry scrap | Other materials | Average rejection per cent |
| 102 | Stationary, plumbago-clay crucibles | Oil and gas | 36 | .. | .. | .. | .. | .. | .. | .. | .. | .. | 5.0 |
| 111 | Reverberatories Tilting iron pots | Oil | 4000 400 | 33.6 | .. | 6.40 | .. | .. | .. | 25.0 | 35.0 | .. | 14.0 |
| 114 | Crucibles in cylinder furnaces | Egg coal | 50 | 92.0 | 8.0 | .. | .. | .. | .. | .. | .. | .. | 15.0 |
| 142 | Stationary iron pots | Coal | 40 | .. | .. | .. | .. | .. | .. | 100.0 | .. | .. | 25.0 |
| 147 | Open flame tilting furnaces | Oil | 150 | 50.0 | 8.0 | .. | .. | 38.0 | .. | .. | .. | Tin 4.0 | 10.0 |
| 153 | Stationary plumbago-clay crucibles | Coal | 40 | .. | 6.0 | .. | .. | 92.0 | .. | .. | .. | .. | 9.0 |
| 191 | Open flame tilting furnaces | Oil and gas | 150 | 96.0 | 4.0 | .. | .. | .. | .. | .. | .. | .. | 10.0 |
| 204 | Tilting plumbago-clay crucibles | Coke | 30 | 44.0 | .. | .. | .. | .. | .. | 44.0 | 12.0 | .. | 5.0 |
| 233 | Hawley down-draft | Oil | 400 | .. | .. | .. | .. | .. | .. | 50.0 | 50 | .. | 3.0 |
| 279 | Stationary plumbago-clay crucibles | Coke | 20 | .. | 8.0 | .. | .. | 92.0 | .. | .. | .. | .. | 5.0 |
| 287 | Stationary plumbago clay crucibles | Oil and gas | 35 | .. | 2.5 | .. | .. | 30.0 | .. | 52.5 | 15.0 | .. | 4.0 |
| 290 | Portable plumbago clay crucibles | Coal | 10 | 90.0 | 10.0 | .. | .. | .. | .. | .. | .. | .. | 0.0 |
| 293 | Stationary crucibles in coke pit | Coke | 33 | .. | .. | .. | 6.0 | 60.0 | .. | .. | 34.0 | 10.0 | 2.0 |
| 298 | Stationary plumbago-clay crucibles | Oil | 40 | .. | .. | .. | .. | .. | .. | .. | Scrap castings 100 | .. | 0.5 |
| 333 | Tilting, plumbago clay crucibles | Coke | 12 | 25.0 | .. | .. | .. | 25.0 | .. | 50.0 | .. | .. | 1.0 |
| 343 | Stationary, plumbago-clay crucibles | Oil and gas | 120 | 33.6 | .. | 6.4 | .. | .. | .. | 40.0 | 20.0 | .. | 3.0 |
| 349 | Tilting iron pots | Oil | 75 | 80.0 | .. | 10.0 | .. | .. | .. | .. | .. | Tin 10 | 2.0 |
| 375 | Stationary, Plumbago-clay crucibles | Oil | 50 | .. | .. | .. | .. | .. | .. | 45.0 | Scrap castings 55 | .. | 4.2 |
| 400 | Stationary iron pots | Oil | 600 | 60.0 | .. | 9.6 | .. | .. | .. | 16.0 | 14.4 | .. | 6.5 |
| 431 | Open-flame tilting furnaces | Gas | 200 | 50.0 | .. | 8.0 | .. | .. | .. | .. | Scrap castings 42.0 | .. | 10.0 |
| 438 | Stationary iron pots | Oil | 50 | .. | .. | 12.0 | .. | 88.0 | .. | .. | .. | .. | 5.0 |
| 455 | Stationary plumbago-clay crucibles | Coke | 50 | 90.0 | 10.0 | .. | .. | .. | .. | .. | .. | .. | 3.0 |
| 472 | Stationary iron pots Stationary plumbago-clay crucibles | Oil and gas | 280 90 | 42.0 | .. | 8.0 | .. | .. | .. | .. | 50.0 | .. | 8.0 |
| 475 | Stationary, plumbago-clay crucibles | Coal | 100 | 70.0 | .. | .. | .. | .. | .. | .. | 28.0 | 50:50 Cu:Mn 2.0 | 4.0 |
| 490 | Stationary, iron pots | Oil and gas | 250 | 8.0 | .. | 8.5 | .. | 50.0 | .. | 3.5 | 30.0 | .. | 3.5 |
| 497 | Stationary iron pots | Oil and gas | 200 | 60.0 | .. | 9.6 | .. | .. | .. | .. | 30.4 | .. | 10.0 |
| 498 | Stationary, plumbago-clay crucibles | Oil | 35 | 30.0 | .. | 9.6 | .. | 30.0 | .. | .. | 30.4 | .. | 10.0 |
| 501 | Open-flame tilting furnace | Oil | 50 | 50.0 | .. | 8.0 | .. | .. | .. | .. | 42.0 | .. | 1.25 |

set wrong, and core shifts, of which cuts through, broken cores, and cores set wrong (or shifts) caused the heaviest losses. Rejections due to molding errors contributed 3.22 per cent of the total losses, of which the greatest number of rejections were due to cope drops, sand holes, and hard or soft ramming. The other causes were responsible for the remaining losses amounting to 8.4 per cent.

Table XVII gives a summary of the more important data regarding causes for losses as given in the replies to the questionnaire. As already indicated, these replies were, in general, unsatisfactory because of insufficient detailed data, but whatever important data was supplied has been summarized because estimates by the individuals in charge of the various foundries are likely to be better than no data at all, and the individual foundryman is in a position to know his losses better than anyone else. However, some of the information supplied cannot be regarded as much better than guesses. In the majority of the replies, the statement was made that no records were kept or that the foundries did not know the causes for casting losses.

*Kind of Cores Used*

The tendency in aluminum-foundry practice is toward the use of green-sand cores wherever possible because of the greatly decreased production costs which may be effected by employing them rather than dry-sand cores. Practice still is rather variable, some foundries using dry-sand cores exclusively for the production of their output, while others use dry-sand cores only where necessary. Green-sand cores are used largely for large automotive castings such as body cores for crank-cases, oil pans, and transmission housings, and green-sand cores are used to an increasing extent in casting cooking utensils. In vacuum-cleaner work, dry-sand cores are generally preferred where cores are necessary. In some foundries, green-sand cores are used for heavy, chunky castings and dry-sand cores for light, open jobs. Dry-sand cores are used practically exclusively for some kinds of automotive castings such as manifolds, pistons, and carburetors, particularly on small complicated jobs which are difficult to run, and green-sand cores are employed where practical in large castings. No figures have been made available as to comparative losses in the production of castings when using green-sand as against dry-sand cores, and ordinarily such figures can have little meaning at best.

Information with regard to the effect of different methods of melting upon the resultant casting losses was sought, but the data furnished have proved to be exceedingly contradictory. As a matter of fact, comparative tests of methods of melting versus casting losses invariable will be clouded by the many other determinate factors which enter into the problem. Thus, some foundrymen employ open-flame furnaces of the tilting or of the reverberatory types and claim that such furnaces are entirely satisfactory from the standpoint of casting losses, while others claim that the only way in which they can keep their losses low is by melting in iron pots. Table XX has been constructed from the information furnished in the replies to the questionnaire.

These figures are highly unsatisfactory, and they are inconclusive. Consequently they cannot be relied upon as criteria to be applied to melting methods in relation to casting losses.

Zinc chloride mainly is employed for fluxing melts of aluminum alloys, and while it may have some value in assisting in the disengagement of occluded foreign matter like dross, the tendency in the United States for several years has been toward discontinuing the use of this salt. Other materials reported as used for fluxes in aluminum-foundry practice include sodium chloride, ammonium chloride, silicon, and borax. The amounts of the various fluxes used per average heat are given in Table XIX. Some foundries stated in their replies that they used special fluxes but they did not state the composition or how much was used per heat.

## Book Review

*Patternmaking;* by Joseph A. Shelly, instructor in patternmaking and wood working; cloth; 6 x 9 inches; 341 pages; published by the Industrial Press, New York, and furnished by THE FOUNDRY for $3 net.

This treatise on patternmaking deals in its sixteen chapters with two general and important subjects which include, first, the principles which govern the production of castings by forming suitable molds from patterns and, second, the actual construction of patterns and coreboxes of different types. The types of patterns which illustrate different problems in the foundry and pattern shop have been selected carefully to demonstrate every important variation that may arise in practice. As the construction of wooden patterns involves considerable skill, especially in the art of joinery, the use of hand and power-operated wood working tools, and the particular classes of work for which they are adapted, are fully described and illustrated.

In dealing with the subject of general pattern construction, the idea has been to explain thoroughly the fundamental features. For instance, detailed instructions are given for the exact procedure in the fitting or joining of different parts, and the method of building up and forming the various shapes usually found among patterns is made clear. The author believes that it is more important fully to explain how parts are sawed, chiseled, planed, turned and fastened together, than to fill the book with miscellaneous and unrelated examples of pattern work.

Primarily the treatise is intended for those interested in patternmaking as a vocation; but it also should prove of value to draftsmen because the origination of designs which are practicable from the view point of the patternmaker and molder requires a knowledge of the fundamental principles of patternmaking. The various subjects treated have been so arranged and divided throughout the book that the student more interested in general principles than in the actual work of construction readily may select whichever sections are considered essential.

## Alabama Increases Pig Iron Production

Alabama produced 2,354,803 tons of pig iron during 1920, according to authoritative figures that have just been issued. This is an increase of 224,711 tons over 1919. These figures will probably undergo some slight changes when the American Steel and Iron institute announces its report of pig iron production for Alabama during the year just ended.

During 1918 the state produced 2,587,852 tons, and the maximum mark was reached in 1917 with 2,953,705 tons. Production during 1920 was held back considerably by the break in the market during the last three or four months of the year. Extensive operations during the spring of the year account for the fact that 1920 production exceeded that of 1919.

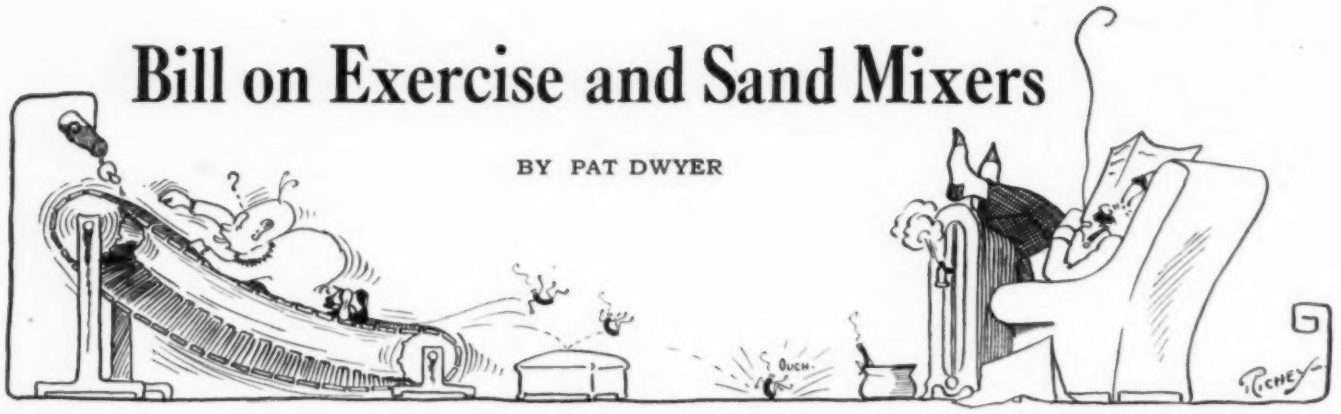
Leaders of the industry in the Birmingham district express confidence that 1921 production will be even greater than that of 1920, though not much activity is anticipated the early part of the new year.

## Takes Grinder Interests

The Cincinnati Milling Machine Co. recently has become financially interested in the Cincinnati Grinder Co. and will manufacture the latter company's universal, plain cylindrical and internal grinding machines. The Cincinnati Grinder Co. recently completed a modern foundry which will be utilized by the two interested firms.

# Bill on Exercise and Sand Mixers

BY PAT DWYER




THE statement frequently has been made that walking is the greatest and most beneficial form of exercise. Personally I am inclined to agree with this claim and I think I may ascribe my physical well being to the fact that I always go for a short stroll every Sunday afternoon. I am not a crank on the subject, one of those fanatics who insist on riding their favorite hobby under any and all circumstances. Not at all. I make up my program with the mental reservation *wind and weather permitting*. When the elements conspire against me and force me to stay in the house, I do not rail against fate and work myself into a paroxysm (whatever that is). No indeed! I accept the condition in a truly philosophical spirit, curl up in a big comfortable chair and peacefully go to sleep. I have been accused of laziness on these occasions by the human dynamo who does me the honor of sharing my humble abode; but what would you? A man has to draw the line somewhere. Exercise is all right in its place and no man believes in its beneficial effect more than I do; but I realize that it is possible to over-do a good thing. I will go out walking on Sunday, or not at all.

Last Sunday was a pet day. In bygone times, in a far away land and among the people with whom I lived the term was used to describe one of those mild sunshiny days which occasionally appeared during the winter season. I have not heard the term used for many years and do not know if it still is current but you know the kind of a day I mean. After dinner I put on a hat and coat preparatory to doing my usual quota of road work, which as I already have pointed out, has done so much toward keeping me in the pink of physical condition. When I was preparing to go out a beautiful young lady who came to our house a few years ago and who has prolonged her visit ever since, intimated that she should like to accompany me. I easily could have refused on the ground that she was not physically capable of enduring two hours of grueling road work; but her mother told me to wait a minute while she got her ready. I have the greatest respect for this mother's judgment and I reflected that if she considered the idea feasible, why should I worry?

Before the young lady, under the most violent protest, had been scrubbed, combed, groomed and wrapped inside of 40 garments, the minute had grown into an hour. I had been moved at various stages of the performance to suggest that we were not going to a beauty show and neither had we any intention of making the North pole our ultimate destination; but I was told that if I had no pride in the child's appearance or if I did not care whether she contracted pneumonia or not, other people had and did. In fact it was intimated rather broadly that it was one of the inexplicable mysteries of divine providence why some unappreciative and hard hearted fathers were blessed with such perfect children.

We got away at last to a fair start and made good time to the ½-mile post which marks the entrance to one of the city boulevards. When I say *good* time, I mean good time under the circumstances. One of us, not to be too specific, was burdened with an overdose of clothes. True her clothes were short; but so were her legs and so was her breath and, since this is a perfectly free and open confession, I may just as well admit that the only thing about her that was not short was her tongue. We made the first half mile in about 30 minutes flat and then walked slowly along the boulevard for a short distance to rest our feet and recover our breath.

While standing on a corner for a few minutes idly watching the large shiny automobiles going by, I was astonished to see a large maroon colored Packard draw up to the curb immediately in front of the place where we were standing. I was astounded still more to discover Bill opening the door and inviting us to step in.

"Come in" said he, "you ought to be ashamed of yourself forcing that poor little child to walk such a distance. Meet my friend Mr. Taurus, he will be glad to give you a lift home."

We entered the car and on the short drive home learned that Mr. Taurus, the large and prosperous looking gentleman sitting in the back seat with Bill was sales manager for what probably was the most exclusive and select real estate company in the city. He said so himself and if a man does not know his own affairs, who does, may I ask? I also learned that he was neither a misanthrope nor a

NO RELATION TO KIPLING'S LADY WITH THE RAG, THE BONE AND THE HANK OF HAIR

pessimist. To use his own expression when referring to those who bewailed the present hard times he wasn't "no crab." He was a man of unusual conversational ability and fairly bubbled over with a joyous faith in the future intellectual and commercial supremacy of the city in which we lived.

He challenged any person (not in the vulgar pugnacious manner affected by some challengers; but in that slap-you-on-the-back-old-man way,) to dispute any of the statements and offered to produce figures and statistics to back up every claim. While every part of the city was growing and real estate values showed a gratifying appreciation in every section, still he wished to point out that the building trend was toward the east. The unerring sagacity of the company with which he counted himself proud to be affiliated had foreseen this trend years before it had manifested itself to others and had secured a large parcel of the choicest land in the district. Recent events had confirmed the keen business acumen displayed by the executive heads of his company. The land was appreciating in value every day and now he was in a position to dispose of a few choice lots at favorable figures to a few carefully chosen and high class home builders.

To be perfectly frank about the matter, gentlemen, his company was not in business solely for money. The executives were not altruists, but at the same time they were not money grabbers, something he regretted he could not say for the average real estate operator. The men of his company had civic pride and when they saw the manner in which the manufacturing and commercial interests were invading what formerly was high class residential property, they had decided to do their share in making the city beautiful by placing the most rigid building restrictions on this particular allotment.

By this time the machine had approached my humble cot and Bill alighted when I did. The large gentleman insisted that it would be a pleasure to drop him at his own door; but Bill said that he had absorbed the salient points in connection with the proposition. He said that he would consult Mrs. Bill and advise him later of his decision. The party of the first part begged him earnestly not to postpone action as the lots were in great demand and it was entirely within the bounds of possibility that if he delayed he would find the golden opportunity gone. Seemingly as an after-thought he suggested that Bill should make a trifling deposit and for that consideration he would hold one of the lots for a limited period. Bill was obdurate, said he would let him know in a day or two and the handsome car rolled away.

FROM HIS PROPRIETARY AIR ONE WOULD ASSUME THAT HE OWNED THE CAR

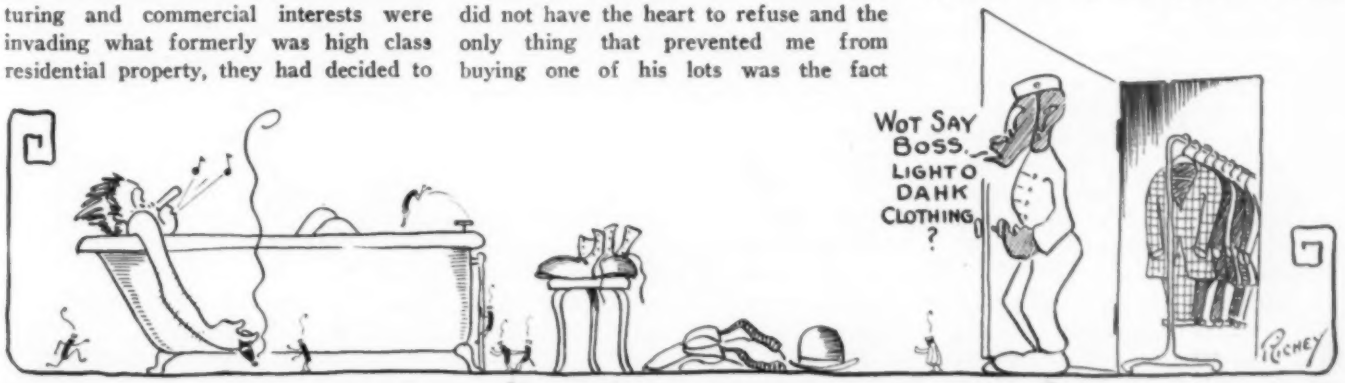
After we had entered the house and deposited ourselves in a couple of comfortable chairs I asked Bill what it all meant; in other words was he contemplating the purchase of a lot.

"No," said he, "I am not. Heaven knows who turned that bird loose on me; but when he came to the house today in that glorious machine and invited me to go look at an allotment known as the Rose of Paradise, I did not have the heart to refuse and the only thing that prevented me from buying one of his lots was the fact that I did not have the price. Those real estate birds certainly are finished artists. I often think what a revolution there would be in the foundry industry if some of these gentlemen were turned loose selling foundry equipment. For instance take the core making proposition.

Every foundry has its standard mixtures which have been worked out by trial and experiment by the men in charge. A comparatively wide variation is possible in this respect without manifesting itself in the casting production. This condition is due to the variation in sand in different parts of the country and also to different castings requiring cores of different character. Shops in the same district, operating on the same class of work, frequently use widely different core sand mixtures.

"Several reasons are responsible for different mixtures, chief among them being a desire for economical operation. Clean sharp sand, that is practically pure silica sand, bonded either with liquid or dry binder in the proper proportions will make perfect cores for any purpose; but owing to the amount of binder necessary they also are the most expensive. Of course, expense is a relative term and really means nothing when it becomes necessary to employ a certain grade of sand and a definite binder for a given line of cores. Cores are only a means to an end. If one core mixture cuts the casting loss lower than another, it is less expensive than a mixture apparently cheaper on the core room floor.

"Molding sand contains a natural bond and, therefore, the more molding sand used in the mixture the less artificial binder will be required. The objection to using molding sand is based



EVEN WHILE IN THE BATH TUB HE IS CALLED UPON TO RENDER QUICK, SNAPPY DECISIONS ON PROBLEMS OF THE FIRST MAGNITUDE

on the fact that owing to the clay content it does not vent freely and, therefore, the maximum amount to use in any core sand mixture depends on the relative position which the resulting cores occupy in the mold. If they are to be entirely or almost entirely surrounded with iron it will be necessary to make them out of pure sharp sand. If they are to be used to form parts of the outside face of the mold, covering cores, etc., they can be made from a mixture containing practically nothing but molding sand, or in some cases, old core sand. Mixtures for every purpose can be made using any proportions between these two extremes.

"It is impossible to lay down a hard and fast rule governing the proper amount of binder to employ. The amount will range in extreme cases from 1 to 10, to 1 to 100. For ordinary cores and under ordinary circumstances, a core mixture made up of half and half sharp sand, also known as sea sand or beach sand, and bank sand bonded with a liquid or dry binder in the proportion of 1 to 20 will be found satisfactory. All the manufacturers of core binders are prepared to furnish definite instructions for any class of cores to any person who cares to send for them.

"Another factor to be considered is the size and shape of the core. Large cores, or cores that stand high on the plates, if made altogether of sand that does not contain an artificial binder will sag out of shape during drying, if they are not supported by artificial aid. These aids may take the form of driers, in the case of small and medium sized cores and plates, pieces of rails, or bricks built up at weak sections in the case of large cores.

"A judicious use of molding sand in the mixture, if the purpose for which the cores are intended does not prohibit its use, will help the cores retain their shape in the oven without having recourse to any form of outside artificial support.

"The interior of large cores can be filled with cinders and molding sand. At one time coke was used freely for this purpose; but present day prices make it more expensive bulk for bulk than core sand and besides cinders are just as satisfactory. Except in extreme instances, where the cores must be extremely strong and rigid, it is not necessary to make the entire core out of a core sand mixture. All that is required in the majority of cases is to line the corebox with core sand in the same manner that facing sand is disposed against the face of a pattern. The arbors also are covered with core sand to give them a *grip* and then the remainder of the space not occupied by the cinders can be rammed full of old molding sand.

"A uniform mixture probably is the most important factor involved in core making. Frequently the binder or the sand or the relative proportion of each is blamed for defective cores when the real reason is due entirely to the manner in which the sand is mixed. When it is remembered that the sole function of a binder is to unite the particles of sand in a compact mass it readily is apparent that if the binder is not brought into contact with each grain of sand its purpose is defeated.

"The only way in which this intimate and thorough dissemination of the binder can be established is through some form of mechanical mixer. Not only does this process produce a thoroughly blended and uniform grade of core sand, but it also makes it possible to use a considerable quantity of old core sand in the mixture. Furthermore, since the binder is distributed evenly throughout the mass of sand, a minimum quantity is sufficient. The impression seems to prevail in some quarters, particularly where mechanical equipment is lacking, that core sand mixers are adapted only to plants handling large quantities. While it is true to a certain extent that mechanical equipment finds its greatest field in foundries of that character, still there are few foundries so small that some form of sand mixer will not prove a profitable investment. Facing sand can be mixed as well as core sand and the economies effected by this method of mixing sand soon will absorb the cost of the equipment.

"Another feature in connection with core making that does not receive the recognition to which it is entitled, is the manner adopted in many places for producing straight lengths of round and other symmetrically shaped cores. Simple inexpensive machines are available for making cores of this character so true to size that in many cases machining the holes in the castings is avoided and yet you can go into almost any foundry and find core makers using split wooden boxes that turn out cores which are neither round, oval or square."

"Bill," said I, "you are wasting your time and your talents. Why don't you provide yourself with half a dozen classy new suits and thus equipped go on a missionary tour among the darkest foundries? It should be a labor of love to preach the doctrine of economy and efficiency among the benighted ones."

"Well,' said Bill, "I'll tell you. The idea sounds good, especially the six new suits; but there are nine good reasons why I can't accept your kind and generous offer. I am married to one of them and she says that she will do no more traveling and the other eight kind of look pleased when I come in the door at night."

## Detroit Stove Firms Pick Officers for 1921

At the annual meeting of three of Detroit's leading stove manufacturing companies officers were elected and reports were given indicating encouraging prospects for 1921.

Edwin S. Barbour, treasurer of the Michigan Stove Co., for several years, retired from that position for a year of rest, continuing however, as a director. Harry B. Gillespie was elected his successor as treasurer. The other officers elected are Chairman of the board, George H. Barbour; president, Charles A. DuCharme; first vice-president, Francis Palms; general-manager, Louis B. Young; treasurer, Harry B. Gillespie; secretary, Charles B. DuCharme; vice-president, and factory manager, Emmet J. Dwyer; superintendent, Richard L. Callan.

The Detroit Stove works re-elected William T. Barbour; president and treasurer; William G. Henry, vice-president; John A. Fry, secretary and general manager, and W. H. Harley, treasurer.

Officers elected by the Peninsular Stove Co., are: Chairman of the board, John M. Dwyer; president, Fred T. Moran; vice-president and general manager, Daniel T. Crowley; vice-president in charge of properties, James M. Dwyer; treasurer, Edwin L. Dwyer; secretary, Alfred B. Moran; purchasing agent, Albert E. Dwyer; manager of furnace department, Francis C. Moran.

## Organize Abrasive Corporation in Boston

The International Abrasive Corp., Boston, recently has been reorganized and now is controlled by Nathan C. Harrison, president. The corporation includes the Harrison Supply Co., Boston, the National Abrasive Co., Amesbury, Mass., and Niagara Falls, Ont., the Superior Corundum Wheel Co., Waltham, Mass., and the Dominion Abrasive Wheel Co., Mimico, Ont. The corporation produces abrasive grains and a wide variety of grinding wheels.

# How and Why in Brass Founding

By Charles Vickers

## Using Silicon Copper

*We should like you to inform us how to use silicon copper in the production of good, merchantable copper castings.*

Use the silicon copper containing 10 per cent silicon only. First melt lake or electrolytic copper under a cover of about 1 inch of charcoal, and charge all the copper into the crucible at one operation, and when it is cold. This can be done by the use of a *deepener* consisting of the bilge of an old crucible. Keep the surface of the copper covered with charcoal and have the crucible perfectly clean before commencing operations. Do not allow any iron to come into contact with the molten copper. Use a carbon rod for stirring. Always add the silicon copper while the copper is in the furnace. When the copper is perfectly liquid and has a sky blue appearance under its charcoal cover, add 1 per cent of silicon copper, broken small, and wrapped in a piece of paper. Stir the copper thoroughly with the carbon stirrer. Then close the furnace and allow it to heat for five minutes. At the expiration of this period pull the crucible; but do not skim off the charcoal. Hold it back from floating into the molds, by holding a skimmer consisting of a section cut from an old crucible, across the lip so as to dip into the copper. Fasten this piece of crucible to a handle, which may be a piece of iron pipe. This skimmer should be made before pouring time and much ingenuity can profitably be expended upon it.

## Piston Ring Brass

*We are having considerable trouble in making piston rings of the following mixture: Copper, 82 per cent; tin, 12 per cent; zinc, 3 per cent, and phosphor tin, 3 per cent. The latter carries 3.5 per cent phosphorus.*

*We lose about 75 per cent of these rings. They are about ⅛-inch wide and ⅛-inch thick, and are compressed in the machine shop. They are turned down from stock patterns. The castings show up brittle in machining and often break into pieces. What should the analysis show for this mixture? Our chemist claims the phosphorus is 0.08 per cent.*

The alloy is too brittle. With 15 per cent tin and 0.08 per cent phosphorus in the finished bronze, there should be no zinc. To make a good spring metal an alloy with a high elastic limit is required. In this connection we believe that iron would be superior to phosphorus. We suggest the following alloy: Copper, 85 per cent; tin, 15 per cent; zinc, none; phosphor tin, none. Melt the copper under a covering of charcoal, and before the tin is added, throw on top of the molten metal 1 pound of yellow prussiate of potash or soda. Allow the water of crystallization to evaporate, then stir in thoroughly. Now add the tin. Allow the metal to heat for a few minutes, then remove and pour. If the phosphorus is preferred, 0.08 per cent is too much and should be cut in half.

## Aluminum Surface Defects

*We are sending for your inspection an aluminum cleaner nozzle casting which contains defects. The castings come out of the sand without blemish, but after polishing the defective spots appear. These defects as you will note appear as detached holes varying in size from a pin point to a grain of rice. As we are having a considerable number of rejections we will appreciate any suggestions you may be able to offer.*

As far as we are able to visualize the mold from the description and by examination of the polished sample submitted, the nozzle portion of the casting carrying the long part of the core, is cast highest in the mold and this part contains the majority of the holes. There is only one at the surface of the round lower section and that comes right where the diaphragm connects within. At this point there is a *draw* inside. That is, on the surface a hole appears, exactly the same as the holes on the nozzle part. Underneath this hole, there is a draw where the core has been. It looks as if all the holes are due to the same cause; viz., shrinkage, internal shrinkage from between the crystals of the metal. It would appear that one of the gates had assisted this shrinkage as the casting was poured two up, and the holes are on one side only; the other holes are sand holes. Why not experiment with changing the gating? Place the two gates opposite; one on the round, heavy section and the other placed so that the gates are cut across the core print into the long section of the casting.

## Revamping Sand Blast for Polishing Brass

*We have an old sand blast machine that is out of commission and we believe it would be suitable for use as a tumbling barrel for polishing small brass parts by the use of steel balls. The holes in the inside cylinder are ⅛-inch in diameter, and we have thought of using steel balls ⅜-inch in diameter. Will you kindly advise if this equipment can be used for this purpose?*

As the steel balls usually placed in tumbling barrels for polishing purposes are ⅛-inch diameter, it is likely that balls ⅜-inch would be larger than would produce the best results. It will depend upon the castings that are to be polished. If they are straight and plain in contour the larger balls may do the work quite satisfactorily, and a trial will determine this point. As the inside of the barrel must be smooth, a lining of sheet brass could be inserted which would cover the holes.

The barrel should be run in a tank of soap water, preferably made from a vegetable soap. Use plenty of balls and fill the tumbler about one-half full of castings and balls and rotate at 50 revolutions per minute for 30 minutes or longer.

## Using Silicon Copper

*Will you kindly advise us what percentage of 15 per cent silicon copper should be used in the case of pure copper ingot, to make sound copper blocks about 6 x 6 x 6 inches in dimensions?*

Silicon copper usually contains 10 per cent silicon and 20 per cent silicon, and of the two the 10 per cent is the best to use as a general rule. Usually, 1 per cent of a 10 per cent silicon copper is sufficient to produce sounnd copper castings. We suggest that 1 per cent be experimented with first, then if the copper fails to lie quiet, the amount of silicon copper can be increased up to 2 per cent. The reason a larger or smaller quantity of silicon copper may be required is that melting methods are not uniform. With careful melting the amount of silicon copper can be reduced as low as 0.5 per cent.

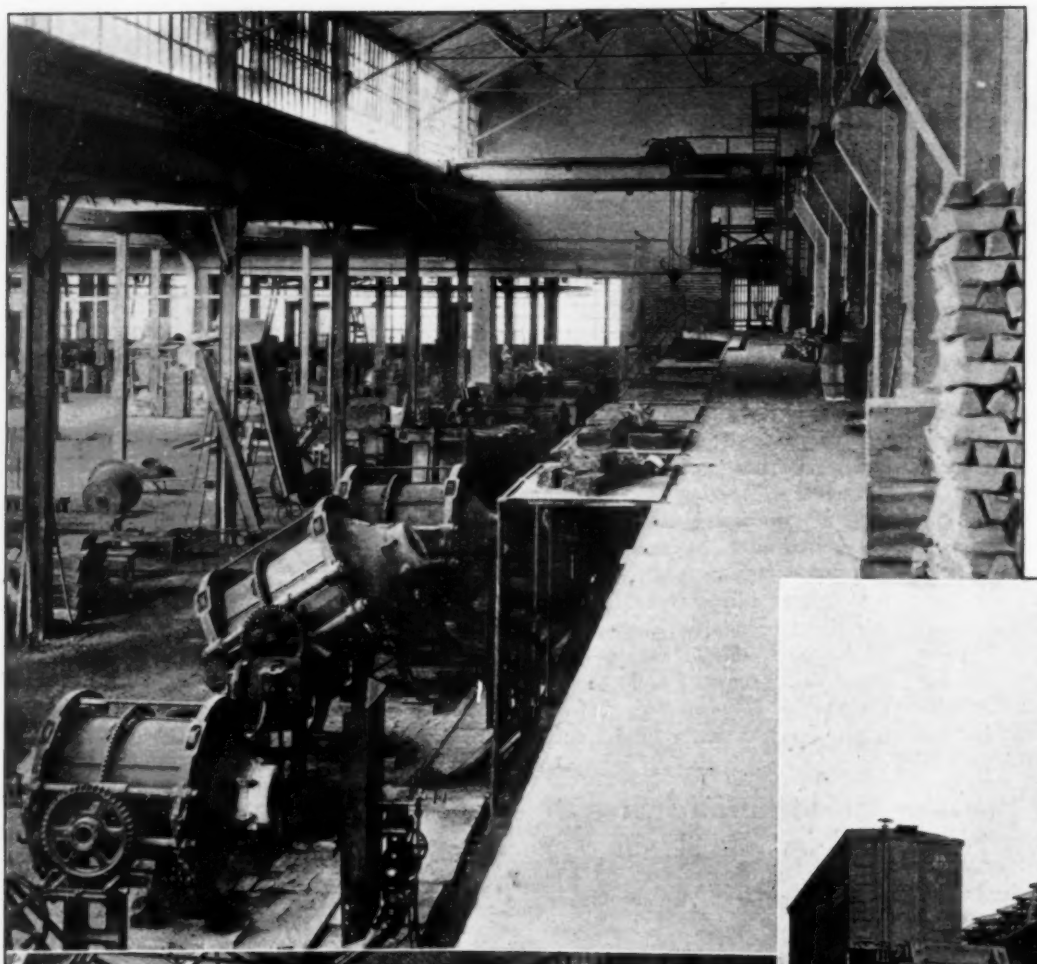


FIG. 1—A PLATFORM IN FRONT OF THE MATERIAL BINS PERMITS METALS TO BE TRANSFERRED DIRECTLY TO THE STAGING BACK OF THE FURNACES —NOTE THE ARRANGEMENT OF BURNERS SET BACK FROM THE ENDS OF THE FURNACES

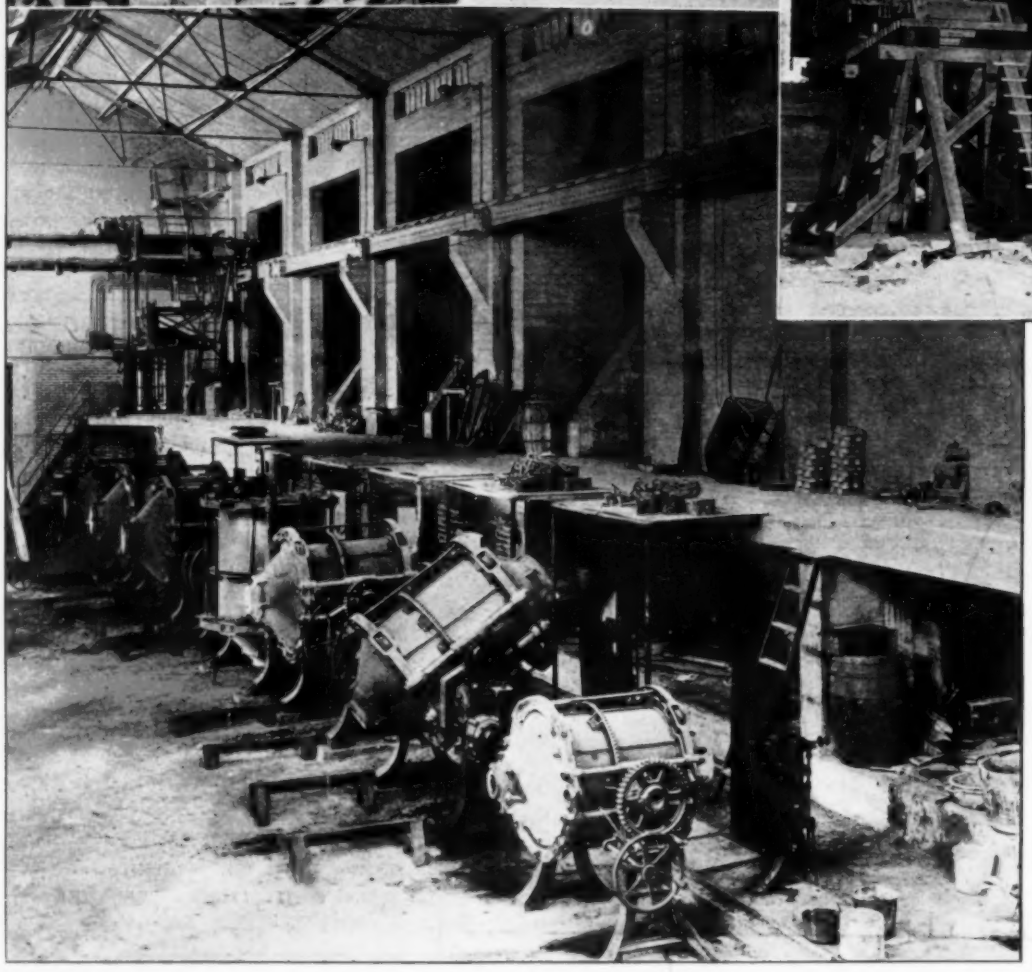


FIG. 2—THE ENTIRE MELTING DEPARTMENT IS COMMANDED BY A CRANE— NOTE THE ARRANGEMENT OF BURNERS SEPARATE FROM THE FURNACES INSERT — THE ELEVATED SIDING IS EXTENDED TO PERMIT CARS TO BE SET OPPOSITE THE ELEVATOR DOOR FOR OUTGOING SHIPMENTS OF CASTINGS

# Makes Asset of a Building Obstacle

## Brass Foundryman Designs New Plant to Take Every Advantage of Site Selected—Unusual Furnace Room and Melting Practice Feature Unique Shop

EVERY foundryman fosters an ambition at some time in his life to construct a plant which is exactly according to his ideals. This ideal establishment when constructed will have all the virtues of the shops he has known and will be characterized by the avoidance of all the trying inconveniences which are present in previous plants. To few is given the opportunity to realize this ambition, and these few often fail to make the most of the chance when offered. An exception is furnished by the shop of the H. Mueller Mfg. Co., St. Louis.

This company for a number of years has made an exceptional line of nonferrous castings, and has established a high reputation for brass and bronze bushings. The necessity for added production under pressure of automotive demand induced this company to build a new plant, and the manner in which it was built under precepts of past experience and made assets of certain natural handicaps, constitutes an interesting chapter in foundry design.

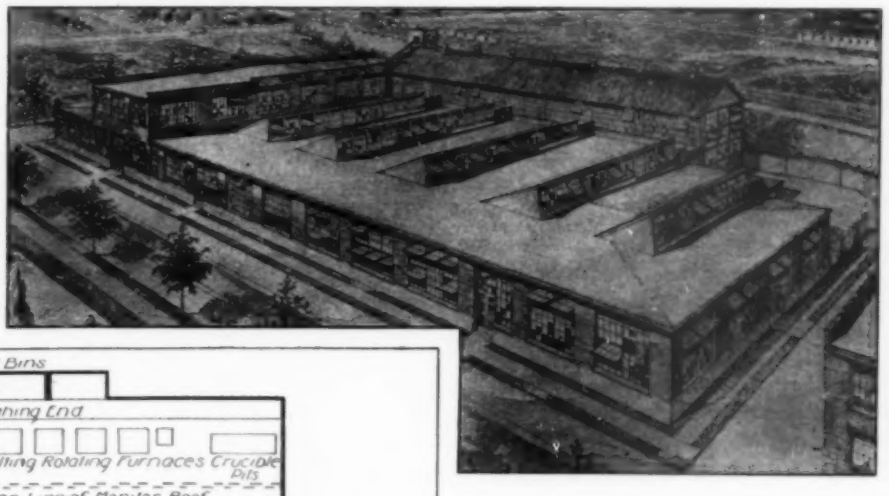
The site available was directly alongside a railway track elevation. In most instances this would have constituted an objection, but in this case the natural topography was utilized to the advantage of the plant.

Obviously, the railroad was essential both to the delivery of raw materials and the shipment of finished products. The plant was constructed directly alongside the elevation, abutting on the grade. In many instances, a spur track would have been constructed from a switch point several hundred feet away, and a gradually descending grade built on leased land would have carried the track down to the level of the foundry floor. Under the system followed, only a short house track was necessary, and this was run in at the same level as the main line, but directly alongside and about 25 feet above the foundry floor. Provision was made at one end for an outside sand storage yard, and then a platform, car-floor height, was built from the outer wall of the foundry to the clearance distance along the track. Under this platform, four double bins, each open on the side towards the foundry floor, were constructed with a manhole communicating with each from the platform. These were divided by sloping retaining walls, which in addition to providing distinct sections in which to classify the different metals as delivered, offered a support against the earth fill that supported the track outside. Fig. 2 illustrates the construction principles involved. A total storage capacity for 42 carloads of ingot metal is provided. The floor of the bins is 8 feet above the floor of the melting department.

The elevated siding is extended upon a wood trestle beyond the line which marks the end of the furnace room. A car may be set on this trestle for loading and an elevator serves to bring finished materials to the level of the shipping platform. Side doors into the elevator shaft open directly upon the platform at the level of the material bins and also on the second floor, over the cleaning room and machine shop.

It thus may be noted from Figs. 2 and 3 that materials can be received or delivered to the railroad directly, or through the opposite end of the finishing room to trucks at the road level.

The high side wall necessary alongside the railway embankment fitted admirably of design. Good ventilation above all other factors is essential with modern brass foundry principles, and this is best provided by high roof with ample window space. This consideration, together with the desire to eliminate so far as possible all unnecessary handling in bringing the metal to the furnaces dictated their location, which as may be noted from Figs. 1 and 2 was provided closely along the outside wall, only allowing sufficient space back of them for a platform upon which to convey the metal to the different



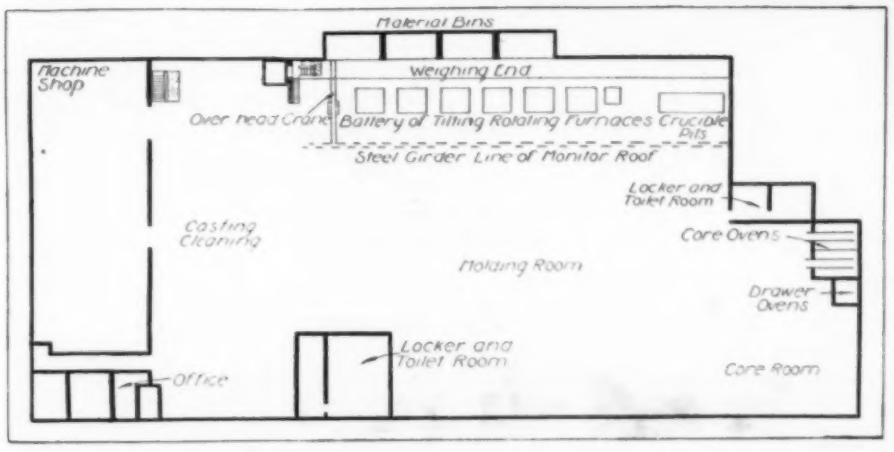



FIG. 3—FLOOR PLAN ARRANGEMENT SHOWING THE DIFFERENT FOUNDRY DEPARTMENTS ABOVE—THE MOLDING FLOOR IS COVERED BY A SAW-TOOTH ROOF, WHILE THE ELEVATED PORTION COVERS THE MELTING DEPARTMENT—THE AMPLE LIGHTING AND VENTILATING FACILITIES ARE EVIDENT

units. The space under the platform was found to be admirably adapted for the oil and air pumping units and service tanks in which to store fuel.

H. Mueller, president of the company, was quick to appreciate the advantage of this arrangement. A tilting type of melting unit had been specified. On large production work in brass, a considerable item of time lost enters in the total interval between pouring and charging. It was apparent at once that when the furnace was tilted forward in position to pour, it would be a great advantage if the metal simply could be thrown into the opposite end of the tilted barrel. For this and other reasons which were mentioned, the floor of the bins and the platform in front of them was constructed eight feet above the foundry floor level. At the back of each furnace, a sheet iron platform, supported upon a frame of pipe, was constructed out toward each furnace, as may be noted. This was to allow the charge in each case to be dropped directly into the elevated open end of the furnace. To accomplish this ingenious arrangement, it was necessary to make the burner entirely separate from the main body of the furnace. Accordingly, the delivery pipes for the oil fuel and the air lines were extended to a height which would support the burner on a line with the center of the opening into the rear of the furnace when the latter was in the horizontal position. The arrangement of burners, each with its shield to protect the operator from reflected heat, is seen in Figs. 1 and 2.

Seven rotating, tilting, oil-fired furnaces manufactured by the U. S. Smelting Furnace Co., Belleville, Ill., are employed in melting the brass and bronze mixtures commonly used by this company. These include four 2000-pound, two 1000-pound and one 400-pound units, and are supplemented by three pit-type pot furnaces which serve for quick melts and for monel metal.

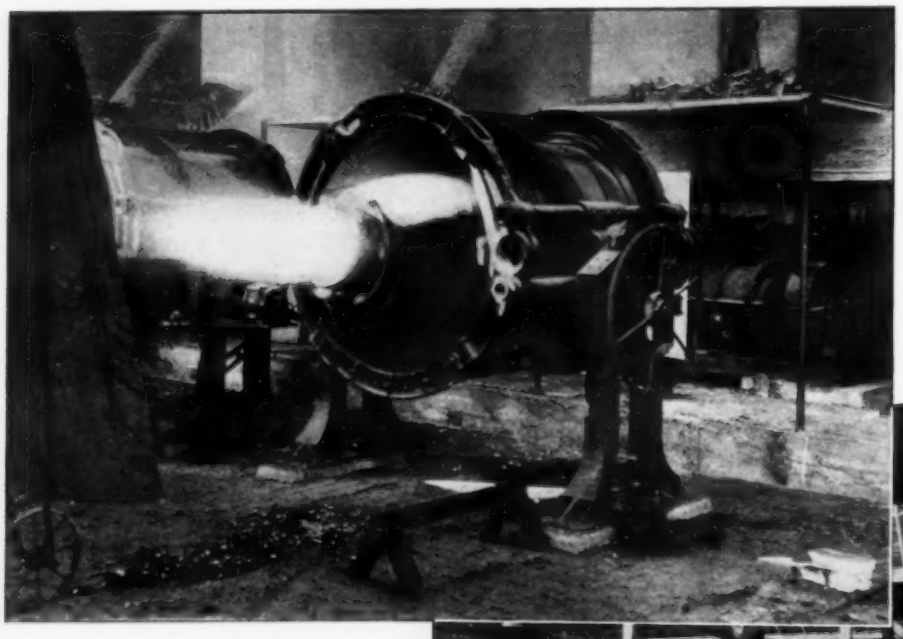


FIG. 4—WHEN THE FURNACE IS OPERATED, THE SHELL IS ROTATED AND THE FLAME PLAYS OVER THE BATH AND OUT OF THE POURING END WHERE IT IS DEFLECTED UPWARD

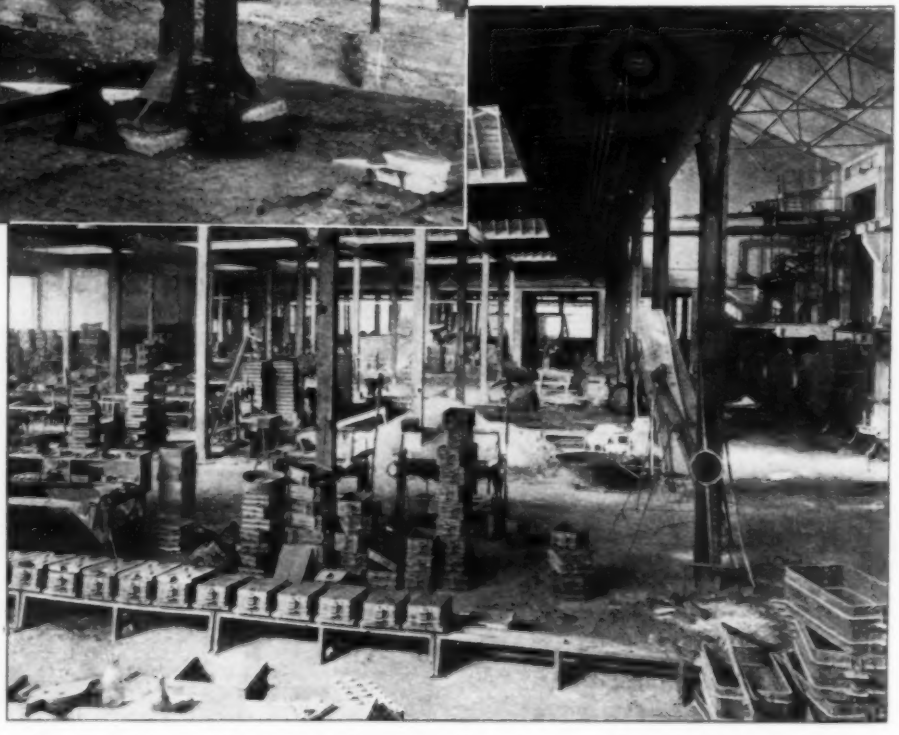


FIG. 5—SMOKE AND GASES ARE NOT NOTICED BY THE MOLDERS, ALTHOUGH THE MAIN MOLDING FLOOR IS NOT SEPARATED FROM THE FURNACE DEPARTMENT BY ANY WALL OR ENCLOSURE

Normally only four furnaces are in operation at a time. These give an output of about 25 tons per day. The average oil consumption is 2.9 gallons per 100 pounds on a 2000-pound charge, and this increases inversely as the amount melted is decreased. Thus a 1000-pound charge requires about 3½ gallons of oil per 100 pounds. An oil meter is now employed in the main line, but others have been ordered and will be installed on each unit. Air pressure at the burners varies from 2½ to 3 pounds, and an unusual system of supplying the air is employed as will be noted. The time required to melt and prepare a heat varies from 1¼ hours for a 2000-pound charge to about 45 minutes for a 1000-pound charge. The small 400-pound unit will melt down a full heat in about 30 minutes, starting with a cold charge. The mixtures used and the melting practice will be given in detail later.

Each of the rotating furnaces is tilted by a hand wheel actuating a worm-gear system, which is visible in the furnace in the foreground Figs. 1 and 2. Rotation upon the horizontal axis is produced by small electric motors individually attached to each furnace. The purpose of this rotative effect is to give a more even mixing of the metal, and also to prolong the life of the lining. When the charge is placed, the furnace is brought back to horizontal and the flame is allowed to play over the mass until sufficient metal is melted to form a puddle of liquid metal. The drum then is placed in rotation. The larger furnaces revolve through a complete turn every six minutes, while the smaller units require only four minutes to complete a revolution. A jump switch permits them to be controlled and rotated either way, forward or backward. However, the direction is constant during each heat.

An exceptionally long life in the linings is reported, the average life

being over 200 heats. Probably this average would become even greater were it not a policy of the company to anticipate any situation leading to a breakdown, and reline the furnace even before the danger point is reached. It is significant that there never has been an instance of the metal eating through the lining to attack the shells of the furnaces.

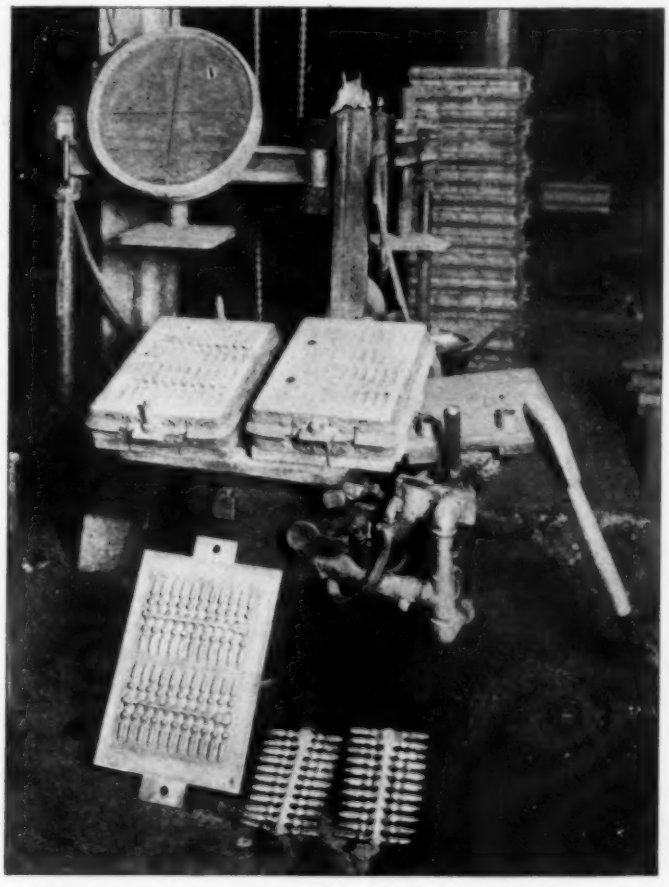
The furnace shells are prepared with a 6-inch lining which is replaced when it wears to 3 inches in thickness. An aluminum oxide or bauxite split brick is used for lining and this is backed by ordinary fireclay. The successive layers of brick are placed flat and lapped over three-fourths of their length to give broken joints, so that any metal which finds its way through the outer layer will not find a direct pathway to the shell of the furnace. Patching is resorted to only on rare occasions. At such times firebrick, crushed firebrick and carborundum sand are used.

The elevation of the charging platform above the floor level was made to serve other purposes as has been mentioned. The 8-foot space under the bins, furnished ample head room for the service supply tanks for oil and for the two Roots blowers which are used to give the air supply for the fuel mixture. Thus a tank capacity for 11,000 gallons of oil is within a few yards of the furnaces, and a further reserve of 30,000 gallons is close at hand in the yard along the track. The location of the service tanks almost directly beneath the railway siding, permits the oil to be drawn off by gravity from tank cars above.

Aside from the convenience previously noted, the furnace arrangement is ideal in reference to the general arrangement of the plant. The high roof, as has been mentioned, covers only this section, and accordingly forms a furnace room which is almost isolated from the remainder of the foundry in the sense that all gases and smoke are directed upward and through the windows above. The furnace room is in effect a monitor section, with the side sashes providing an excellent draft. The direction of the flame through the furnace in each case would carry it across the foundry floor, but portable sheet steel screens, similar to the temporary backstops provided on the baseball diamond during batting practice, serve to direct all the heat and flame upward and thus assist the natural draft in removing the gases.

The shop is devoted almost entirely to light work, as has been mentioned. For this reason cranes are not required to handle the rigging, molds, ladles or castings. Practically the only service required from a crane is in dismantling or assembling the furnaces incident to relining the shells. In this case, the high roof provides ample head room over the furnace section, while the outer wall affords stable support for one track of the crane, and only a single row of steel columns is required to carry the other track. The plant was constructed at a time when fabricated steel was at a premium and for this reason it was fortunate that wood columns and beams could be made to serve the main foundry floor, as is noted in Fig. 5. The crane serving the melting department is a 3-ton unit with a 33-foot span. It was made by Pawling & Harnischfeger, Milwaukee.

The Mueller company, by reason of the exacting service to which its products are placed, exercises complete and exceptionally minute metallurgical control upon all its melting operations. Philip R. Sabin, the metallurgist has final authority in all details attending this important step in the manufacturing processes. Normally, sufficient work is provided that an entire day may be devoted to casting one particular mixture or alloy. Under this practice, at least



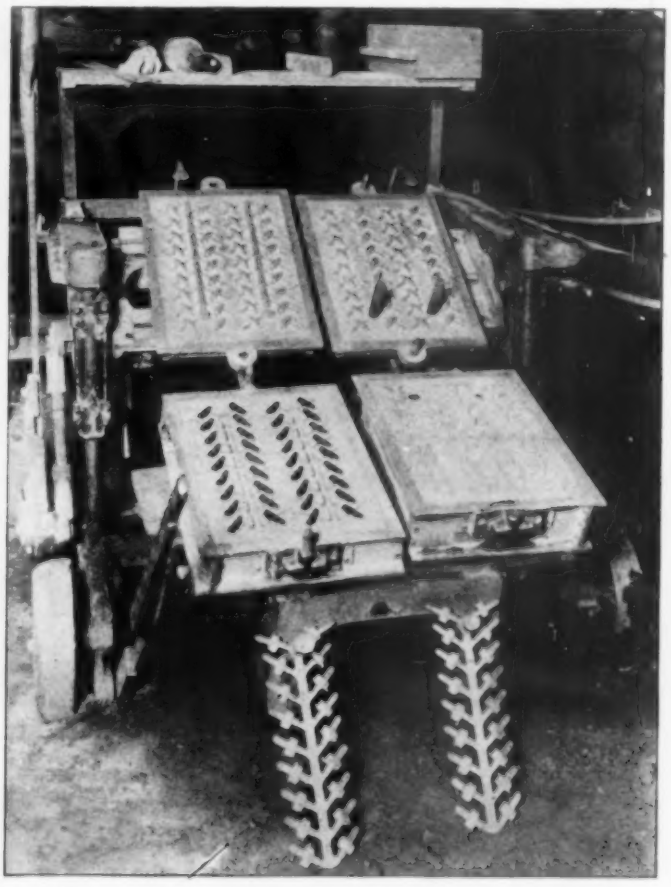


FIG. 6—A JOLT SQUEEZER MOLDS COPE AND DRAG TOGETHER FOR THE PLUGS FIG. 7—THE BODY PORTION OF THE COCKS ARE MADE ON A PLAIN SQUEEZER AND ARE CORED AS SHOWN

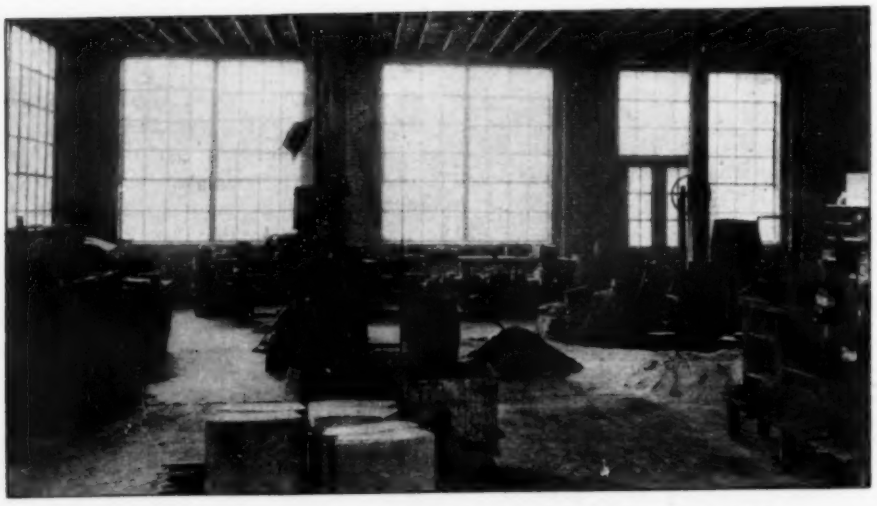


FIG. 8—THE COREROOM OCCUPIES ONE CORNER OF THE SHOP

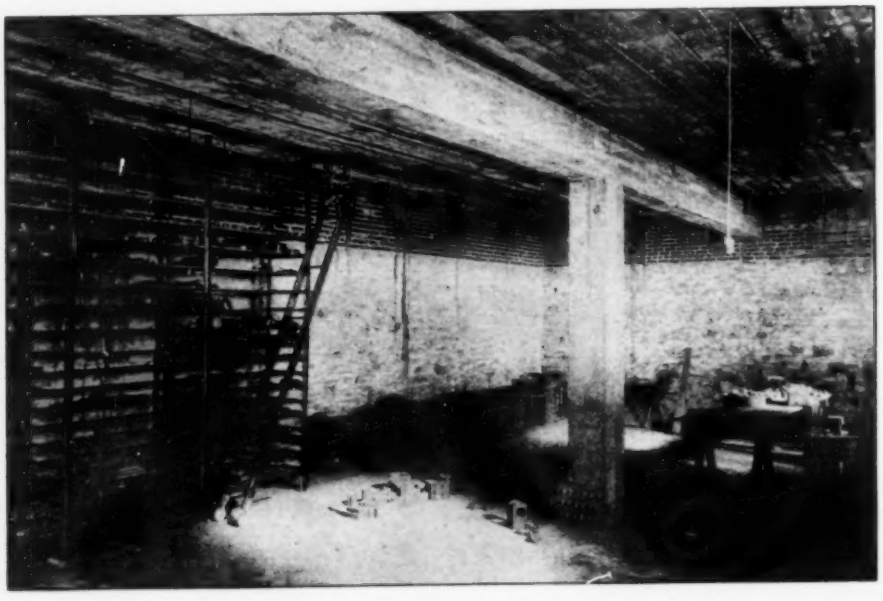


FIG. 9—CUSTOMER'S PATTERNS HAVE A FIREPROOF VAULT

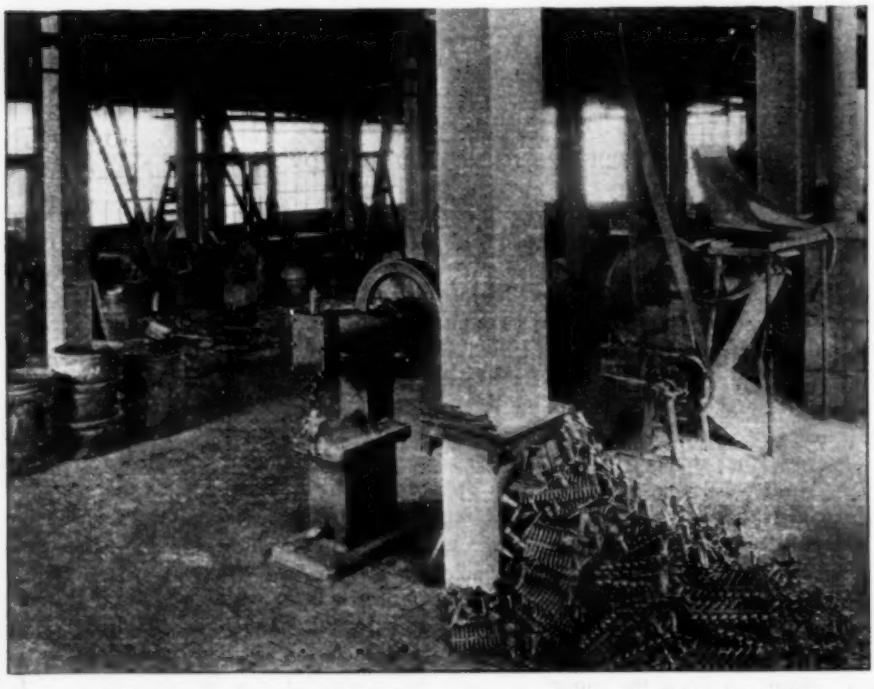


FIG. 10—FINISHING EQUIPMENT IS SHAFT DRIVEN FROM A MOTOR

one sample of the metal as delivered to the molding floor is analyzed each day. As was noted previously, each charge is weighed accurately.

The metals charged are in the form of ingots, dross, copper scrap of known analysis, clean borings, gates, defective castings, lead, tin, zinc, tin borings, grindings, and spills. Rillton brass cleaner, borax and soda ash are the materials commonly used in treating the melts. The borax is used to aid in retaining the tin in the molten mass and to prevent surface oxidation, while the soda ash is used as an anti-sulphur agent. A total of about 2 per cent of the fluxes mentioned is used. The use of fluxes has reduced the skimmings to 8 per cent of the metal.

Occasionally phosphorus is used, about 1 inch of a stick being added to a 200-pound pot except when excess phosphorus is desired. When heavy castings show a tendency to crack, a slight excess of phosphorus is used. The company has had some success in use of fused zinc chloride as a flux. This substance does not absorb water. The melting procedure is worthy of note.

### *Melting Practice Exceptional*

Fluxing agents are placed in the furnace or crucible first. Then the borings and fine materials are added and the melting is started. When lead and tin are used they are added immediately after skimming. Zinc is added just before the heat is poured.

Monel metal which has been found by some to be difficult to handle, is cast with uniform success by this company. The melting problem has constituted the point of greatest difficulty in some plants and its successful solution by the Mueller company has been responsible for the excellent results obtained in some difficult castings in this metal. Further, the company has not been reticent but has been willing to aid other foundrymen by sharing its experience.

The monel metal is melted in the pit furnaces alone, and never less than 90 pounds is charged in a pot. In a 100-pound charge, 1 ounce of aluminum and 3 ounces of the American Boron Products Co., No. 22 flux is placed in the bottom of the crucible. The metal is then placed in the crucible which is closed and set in the furnace. An additional 3 ounces of the No. 22 flux is added about twenty minutes before drawing. The important consideration in handling the metal is to pour it at the proper temperature. This should be about 200 to 300 degrees above the melting

point, which is 2480 degrees Fahr. At pouring temperature the metal is very fluid and runs like 8-per cent tin bronze.

Miscellaneous aluminum castings, aluminum patterns, etc. are made from time to time. The common No. 12 alloy is used, and occasionally an admixture of 2 per cent of tin is made to prevent cracking. This alloy with the tin addition also is used in castings which are destined for use in acid work in local chemical establishments.

Variety in product, even though the plant was built primarily for the manufacture of automobile brass bushings, has resulted from the ability of the company to meet any unusual problem. Exceptionally large bushings, some weighing as much as 1100 pounds have been cast successfully. The largest made has been for sugar mill use. A wide range of small impellers for centrifugal pumps also have been manufactured from different alloys. A characteristic job which represents the extreme of small work undertaken, is represented by the two castings for gas stove cocks shown in Figs. 6 and 7. These are respectively the body and plug portions and together they constitute the complete cock.

The body is molded, cope and drag together, on a plain squeezer, 36 to a flask on two gates. Small cores are used to form the portion into which the plug later is fitted, as noted in Fig. 7. The plugs are made 22 on a gate, two gates to a flask, and are molded on a jolt squeezer. The substitution of a jolt squeezer for a plain squeezer machine increased the output of one man from 85 to 105 molds per day.

Automobile bushings are made closely to dimension to prevent waste of time, labor and material in the subsequent machining operations. The usual allowance for machining on this class of work is $\frac{1}{64}$ inch on the inside and 1/32 inch on the outside. The bushings commonly are cast on end. The cores are made from molding sand with no binder. The core sand is mixed to about the consistency of that used in making the molds. After being molded to the desired shape, cores are coated with a mixture of molasses water and plumbago and placed in the core ovens for drying. This blacking gives an exceptionally fine surface to the inside of the bushings.

Molding machines are used wherever it is possible to adapt them to the work at hand. The bushing job, of course, is production work and lends itself well to machine molding. Space has been provided for 60 molding machines and bench facilities for 10 floors additional. At present 17 machines made by the Arcade Mfg. Co., Freeport, Ill. and 3 plain bumpers built by the U. S. Molding Machine Co., Cleveland, are in service.

Three 6x15-foot rack-type and one small drawer-type oven provide sufficient capacity for baking the cores required. These ovens all are oil fired and are provided with a suction fan exhaust to draw the moisture from about the cores during baking. The cores, which are baked in the larger ovens are placed on racks that are elevated above the floor so that a lift truck made by the Lewis-Shephard Co., Boston, may be employed to transfer them into and out of the ovens. One coremaker to each two bench molders and two coremakers to each group of three molding machines is the usual force required to furnish all the cores needed.

As a special service to its customers, the company built a separate fireproof storage room for its patterns. In this are kept all of the patterns and pattern plates which are used, so that prompt replacement of parts may be made when desired.

Wherever possible automatic control has been substituted for manual operation in the equipment about the plant. This is typified both in the air compressor and blower installations. A 50-horsepower General Electric motor is direct connected to a 10 x 12-inch compressor. This motor is controlled by a special device manufactured by the Cutler-Hammer Mfg. Co., Milwaukee, and is so devised that when the pressure drops below a fixed point a switch is thrown which sets in operation a starting set that gradually brings the motor up to full rated speed of 250 revolutions per minute. When the maximum pressure in the air storage system is reached an automatic cut out is actuated and the

(*Concluded on page 206*)

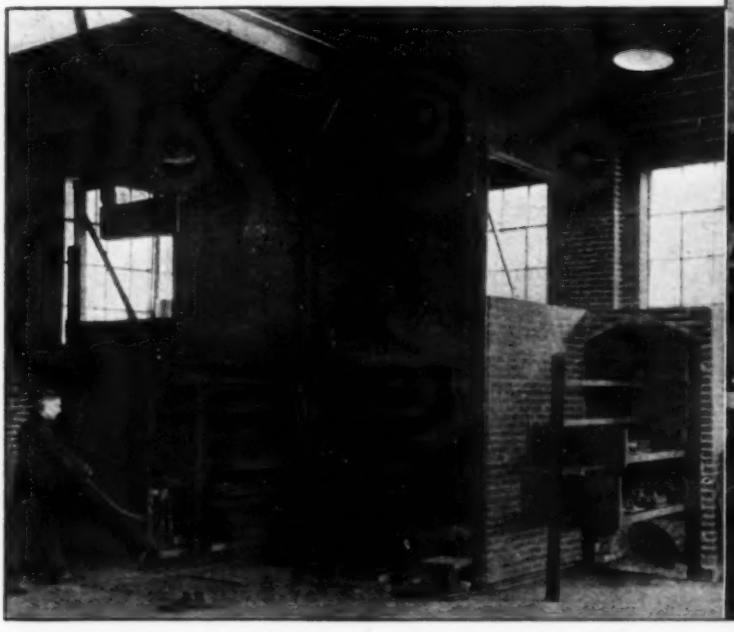


FIG. 11—AMPLE OVEN CAPACITY IS SUPPLIED FOR THE MULTITUDE OF CORES REQUIRED FIG. 12—TRANSFORMERS, CONTROL APPARATUS AND A MOTOR GENERATOR SET ARE IN A SPECIAL ROOM

# THE FOUNDRY

*Registered U. S. Patent Office*

A semimonthly journal devoted to all branches of the foundry trade

Published by
THE PENTON PUBLISHING CO., CLEVELAND

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United States and Mexico.....$3.00 a year
Canada.....$4.00 a year
Great Britain and other Foreign Countries.....$5.00 a year
Single Copies.....25 cents

Copies published three months or more previous to date of current issue, 50 cents each

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## A Promise and an Appreciation

WHEN the first issue of THE FOUNDRY appeared 29 years ago, a pledge was taken and a promise made to the industry which this magazine serves. The ideals of the publication were defined clearly in an editorial of the initial issue, from which the following paragraph is taken:

> The subject of a foundry paper is not a new idea. The attempt to supply the need is, but although always sanguine, we have been the recipients of such assurances of support and encouragement from all over the country since it has become known that we contemplated this step as have surprised us beyond measure, and demonstrated more completely than anything else could at this time, the existence of a universal demand for a paper whose sole object would be the advancement of the foundry industry and all connected therewith. We have come to stay. THE FOUNDRY is a winner, and will, it is hoped, add one more to the already long list of prosperous trade publications for which America is noted. It proposes to become indispensable to every foundry proprietor, superintendent and foreman in the country who is desirous of keeping posted on current events, and to note the improvements constantly being made on present methods. The ambitious molder will see that it reaches his home regularly, and is carefully preserved for future reference. New items from all parts of America will receive particular notice, while mechanical articles by the best writers will be given the attention so necessary for a publication of this kind, and as time goes on new features will be added, until nothing will be left to be desired.

The thoughts here expressed established the creed of THE FOUNDRY. From the beginning, the magazine sought to be indispensable to the foundryman through serving his interests and securing for him the technical information and current news which directly affect his business. That this creed has been upheld and the purposes of the industry served is attested by the steady growth which has broadened the field of subscribers until finally semimonthly instead of monthly publication was necessary. These evidences that THE FOUNDRY is keeping the faith with its readers are gratifying, as they constitute the measure of success. However, other and even more welcome rewards are found in the words of appreciation from those who have been the staunch friends of the magazine since its inception. These are spoken without solicitation to our men who travel about among the foundries of the country. At other times, the kindly word is received through letters similar to one here quoted, which accompanied a copy of Volume 1, Number 1, containing the statement of ideals before mentioned. This letter, from a foundryman of Alabama, in part is as follows:

> "My father now is dead, having died in 1913. He would never be without your magazine during his lifetime and a great many of the old copies are stored away at home now. He wouldn't allow any of us children to destroy a single one of them and always looked forward to the date of its delivery to him.
>
> "We are subscribers to your valuable magazine now and I think that it has been coming to our family directly and indirectly ever since it has been started. Today we would not be without it for five times the subscription price. If there is anything we want to look up or know, all we have to do is to look in one or two issues of THE FOUNDRY and we find just what we want to know.
>
> "I am sending this first issue of THE FOUNDRY to you thinking maybe you would be glad to get it."

# Trade Outlook of the Foundry Industry

CLOSE observation by those intimately acquainted with industrial conditions seems to indicate a slight betterment. Although the great majority of the foundries of the country still are operating at a minimum, their confidence in the future is expressed through purchases of metals and fuel, even though at the present rate of production their stocks would be ample for ninety days to six months. These purchases are not in large quantity, but they are sufficient to point the trend of industrial thought.

**Improvement Will Be Slow**

No confidence is expressed in the hope of an early return to general activity. The shock to the whole economic structure of the country has been too severe to admit of a rapid recovery. In a recent bulletin of the Federal Reserve Board, a slow return to normal is predicted. It is stated that many prices still are too high, while others had been deflated to a point where they do not accord with production costs, and in consequence conditions will remain unsettled for a period and the adjustment will take time. Pig iron and coke have declined strongly during the past month, and still continue unsettled. The lowest price noted in sales by producers to foundry interests has been $26.50 for southern foundry grades, $27 for valley iron and $28 for iron from eastern Pennsylvania. Lower prices govern resale iron, and one large lot of basic was sold by a valley interest to a Cleveland trading company at a price said to be in the neighborhood of $22 per ton. The number of sales of iron have increased from week to week during February, but the aggregate tonnage has not been large. Pig iron production has been curtailed still further throughout the country.

**Prices of Raw Materials for Foundry Use**
CORRECTED TO FEB 23

| Iron | | Scrap | |
|---|---|---|---|
| No. 2 Foundry, Valley | $27.00 to 28.00 | Heavy melting steel, Valley | $15.00 to 15.50 |
| No. 2 Southern, Birmingham | 27.00 to 29.00 | Heavy melting steel, Pitts. | 15.00 to 16.00 |
| No. 2 Foundry, Chicago | 28.00 to 30.00 | Heavy melting steel, Chicago | 15.00 to 15.50 |
| No. 2 Foundry, Philadelphia | 28.54 to 29.54 | Stove plate, Chicago | 19.50 to 20.00 |
| Basic, Valley | 25.00 | No. 1 cast, Chicago | 20.50 to 21.00 |
| Malleable, Chicago | 30.50 to 31.50 | No. 1 cast, Philadelphia | 22.50 to 23.50 |
| Malleable, Buffalo | 30.00 to 32.00 | No. 1 cast, Birmingham | 21.00 to 23.00 |
| | | Car wheels, iron, Pittsburgh | 21.00 to 22.00 |
| Coke | | Car wheels, iron, Chicago | 20.00 to 20.50 |
| Connellsville foundry coke | $6.00 to 6.50 | Railroad malleable, Chicago | 17.00 to 17.50 |
| Wise county foundry coke | 8.00 to 9.00 | Agricultural mall., Chicago | 17.00 to 17.50 |

**East More Active**

The varied nature of manufactures in the eastern section of the country has permitted a higher average operation than is noted in the foundries of the central states and in the south. The textile and leather industries again have resumed operation and have brought into effect a steady demand upon the foundries which handle machine parts required. An increase is noted in the demand for furniture hardware and for parts for scales, small domestic appliances, garden and small hand tools and cast hardware. One large manufacturer of lawnmowers in the east has sufficient orders to occupy the plant full time and overtime until the last of July. The contrast between the situation in this section and that shown in the other parts of the country is further shown in the malleable castings industry. In general, the output of malleable castings for the entire country during January was in the neighborhood of 59 per cent of capacity. The eastern plants exceeded this figure, and during February many of them approached normal operation which is above 75 per cent of capacity. This condition arose from the varied character of the castings made in the eastern shops. In the central and middle western states, the railway and automobile demand failed to furnish work that would maintain operations at more than 25 to 30 per cent of capacity. The machine tool industry in all sections has been exceedingly quiet and little hope is expressed for a rapid recovery in this line although price reductions of from 10 to 20 per cent have been made.

**Railroads Not a Factor**

No evidences are at hand which will indicate an early buying movement in railway equipment which would serve to provide foundry business. The passage of the Winslow bill by the house some weeks ago has been unproductive of result in securing for the railroads the sum of nearly $400,000,000 due under the guarantee account of the transportation act. The senate has failed to pass the bill, and even were it passed at this time, it is doubtful if the entire amount would become available from the treasury at once to meet past obligations of the railways and enable them to buy new equipment. Stove foundry activity is uneven. The eastern and midwestern shops have little business, but the southern foundries have reopened almost upon full schedule. Buying of cast-iron water pipe is somewhat restricted by prices and difficulty in financing, but the seasonal demand has brought about increased operation in many of the larger pipe foundries. Radiator and sanitary ware manufacturers have been buying iron in increasing tonnage during the past two weeks, and general plumbing goods concerns also have given the same indication of bettering conditions. In general, however, the average gray iron and steel foundry activity is at a low ebb. A survey made by a large pig iron producer in northern Ohio disclosed that the average scale of production is only from 20 to 25 per cent of capacity. Makers of electrical sundries and agricultural implement castings have noted little evidence of betterment in their fields.

**Nonferrous Quiet**

Manufacturing lines with which the nonferrous foundry industry is identified still have not recovered to a point where betterment is noted in the demand from castings. Prices of nonferrous metals based on New York quotations in the *Daily Metal Trade* of Feb. 24, follow: Castings copper, 12.37½c; lead, 4.00c to 4.12c; Straits tin, 32.00c; antimony, 5.20c; aluminum, No. 12 alloy, producers price, 27.30c and open market, 19.75c to 22.00c. Zinc is 4.80c to 4.85c, E. St. Louis.

# Comings and Goings of Foundrymen

EDWARD W. BEACH, until recently general manager, the Ferro Machine & Foundry Co., Cleveland, was elected president of the company at the annual meeting held Feb. 5. Mr. Beach joined the Ferro organization in August, 1919, as assistant to the president, Crispin Oglebay. At the annual meeting, 1920, he was made general manager, Mr. Oglebay, who had held that position retiring from active connection with the company in order to devote his time to the Oglebay-Norton Co., Cleveland. Mr. Beach began his foundry career by organizing the Manufacturers' Foundry Co., Waterbury, Conn., in 1900. He was among the first foundrymen in America to specialize in automotive castings and has been intimately connected with the automotive industry since its inception, having served as a director of the National Motor & Accessory Manufacturers' association for six years. During the war, Mr. Beach served, in the grade of captain, as assistant to the chief inspector of production in the air service. The other officers elected at the annual meeting were James F. Leitch, vice president and treasurer, and William D. Sweeny, secretary and assistant treasurer. William W. White was elected to the board of directors as a new member to fill a vacancy. Mr. Oglebay will serve as chairman of the board of directors and Mr. Beach will continue as general manager. Other executives who are identified with the Ferro organization are John T. Stoney, engineer and manager, foundry division, Raymond E. Stoney, foundry superintendent, and Henry B. Myers, manager, machine shop division.

T. E. Malone, of Pittsburgh, is spending the winter at Odessa, Fla.

R. J. McSherry has severed his connection with the Hercules Gas Engine Co., Evansville, Ind., and has been appointed special representative of the Peterson Core Oil Co., Chicago.

A. E. Hammer, general manager of the Malleable Iron Fittings Co., Branford, Conn., has been appointed as a member of the general welfare committee of the Connecticut Chamber of Commerce.

Malcolm R. Maclean has resigned as secretary and sales manager of the Duquesne Steel Foundry Co., to become sales manager, castings division, Penn Seaboard Steel Corp., Philadelphia.

Justus Egbert has been appointed purchasing agent for the American Radiator Co., Buffalo, succeeding E. F. Fitch who resigned to become associated with the Florida Terminal Co. F. J. Arnold has been made assistant purchasing agent.

EDWARD W. BEACH

John H. Dickerson, treasurer of the Rhode Island Malleable Iron Works, Hillsgrove, R. I., completed 25 years service with the company Feb. 14, and his associates remembered the occasion by presenting him with a silver gift.

Clayton O. Smith, secretary and treasurer of the O. S. Walker Co., Inc., Worcester, Mass, grinding machines has been elected president of the Worcester section of the Worcester Polytechnic Institute Alumni association. He was a member of the class of '92.

Lawrence Wilkinson Wallace was elected secretary of the American Engineering council at the meeting of the executive board in Syracuse, N. Y. on Feb. 14, succeeding L. P. Alford of New York who has been acting secretary since the formation of the council in Washington on Nov. 19, 1920. Mr. Wallace has been one of the most active figures in the council and from the time it was organized has been its treasurer. As vice-chairman of the council Mr. Wallace has been directing the work of the committee on elimination of waste in industry.

Thure Hanson, who was connected with the welfare department of the Crompton & Knowles Loom Works, Worcester, Mass., the past year, has become employment manager of the Morgan Construction Co., in that city. He succeeds Roger F. Knight, who resigned Feb. 1, and who will take a vacation before entering on other work.

Alexander England, Wilkinsburg, Pa., for eight years assistant engineer, the Westinghouse Airbrake Co., has been appointed chief engineer, succeeding S. W. Dudley, who resigned Feb. 1, to accept a post as professor of mechanical engineering at Yale university. Mr. England has been connected with the Westinghouse company since 1908.

B. D. Fuller, Defiance Paper Co., Niagara Falls, N. Y., recently has purchased an interest in the West Park Foundry Co., Cleveland. James Reilly, formerly general foreman of the Westinghouse Electric & Mfg. Co., Cleveland, when Mr. Fuller was superintendent for that company, is manager of the West Park Foundry Co., and Thomas Reilly, Atlantic Machine Co., Cleveland, is the third member of the firm.

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## Compares Present with Post Civil War Times

His vivid recollection of the good business conditions that followed soon after the close of the Civil war causes him to believe that business in this country is going to be good before long, said Thomas Devlin, Thomas Devlin Mfg. Co., Philadelphia, and president of the Philadelphia Foundrymen's association at the February meeting of that body.

"It is true there is a lull at the present time," said Mr. Devlin, "and we think it good that we have a little breathing spell after the break-neck speed at which we have been going for the past three or four years. It gives us a chance to stop, look and consider, and to plan for

ROAST OX AND PIG GAVE MORE SAVORY SURROUNDINGS THAN USUALLY ARE MET IN THE FOUNDRY

a revival as soon as credit conditions are righted; and the problems of credit the practical financiers and business men will solve by intelligent co-operation with and active support of the American and European governments, which are most deeply interested in restoring conditions to what they were before the war.

"Believing as we do that credit conditions will be restored in the near future, the coming summer should see a steady and continuous demand for all the goods that can be produced. Our opinion, as we said before, is based on the busy times that existed in our own country after the Civil war and these lasted from 1865 to about 1872. During that period we repaired the damage that was caused at home, whereas now the waste of the world has to be made good. Countries depending on America and Europe have had six years of famine in goods that they need and must have as soon as credits are established."

Mr. Devlin submitted at the meeting a letter from the American exchange National bank, New York, requesting his views with respect to the commercial practice of granting a discount for cash. The bank took the view that granting of such discounts may be more a matter of habit than inherent value and it quoted various objections to the practice. In his reply, which was read at the meeting, Mr. Devlin expressed the opinion that the use of discounts for cash is highly beneficial both to buyer and seller, and that it induces careful buying. When discounts are not taken, he declared, trade acceptances should be insisted upon, dated 30 days after date of bill with interest. A. W. Bowie, of Dwight P. Robinson & Co., Inc., 125 East Forty-fifth street, New York, submitted an interesting paper on foundry design.

## Tells Foundrymen About Chinese Manufacture

"Industrial China" was the subject of a discussion at the regular February meeting of the New England Foundrymen's Association which was held Wednesday, Feb. 9 at the Exchange club, Boston. The principal speaker was Frank A. Foster of Auburn, R. I. Mr. Foster is a member of the American Chamber of Commerce, Shanghai, China, and is in this country at the present time gathering information and contracting for machine shop and foundry equipment. He has made an extensive study of foundries and foundry practice in China, and illustrated his talk with many photographs of Chinese iron foundries taken by himself.

## Company Holds Barbecue for Its Employes

The Darbyshire-Harvis Iron & Machine Co., El Paso, Texas gave its employes a barbecue on New Years Day as a testimonial of its appreciation of their faithful services during a successful year. The function was held in the new addition to the foundry, where an ox and a pig were roasted. At this celebration a feeling of good fellowship between employer and employe was manifested.

The Darbyshire-Harvis company is one of the largest of its kind in the Southwest, manufacturing all kinds of mining and milling machinery which is shipped throughout the southwestern portion of this country and to Mexico. Much of the credit for the success of the company is attributed to the active participation in its affairs of its founder, B.. F. Darbyshire, who at present occupies the office of president.

The accompanying illustration, from a photograph taken of the gathering at the barbacue, shows the superintendent of the plant, M. F. Gorey, standing a little to the left wearing a white apron. Frank Leary, foreman, may be seen at the extreme left with his young son in his arms. Mr. Darbyshire is at the left of the lady in the foreground.

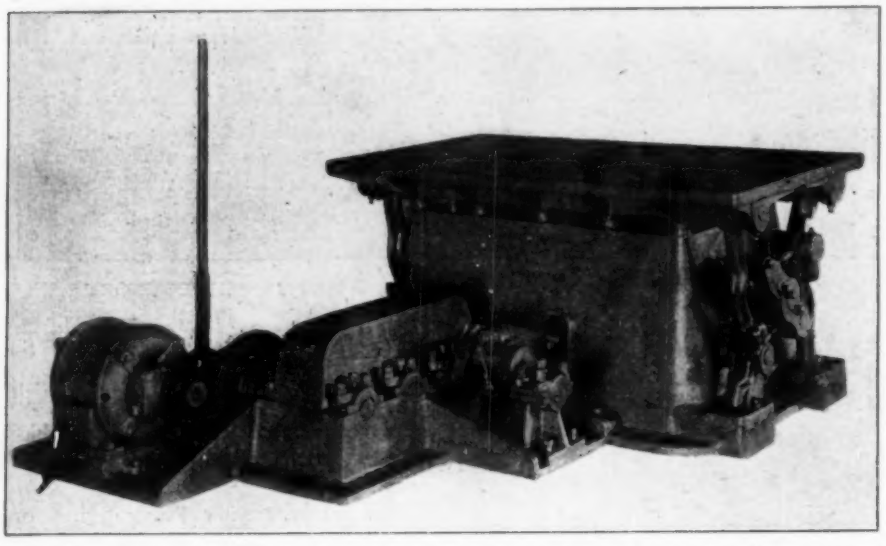
## Building New Foundry for Ammonia Fittings

E. E. Lindgren, one of the pioneers in the manufacture of semi-steel castings and high pressure and ammonia fittings, is building a new foundry at Batavia, Ill. About a year ago, Mr. Lindgren purchased the plant of the Curtis Form-a-Tractor Co., Batavia and remodeled it into a modern foundry, doing business under the name of the Lindgren Foundry Co. However, in September 1920 the plant was totally destroyed by fire, of unknown origin. The present plans call for a foundry 175x80 feet. Work of construction is already well advanced and it is expected operation will be started soon.

R. F. Eissler has been made assistant to the vice president of the Chicago Pneumatic Tool Co., New York city. W. C. Straub, formerly district manager at New Orleans has been transferred to the Pittsburgh office to succeed Mr. Eissler and Ross Wyeth, formerly attached to the Pittsburgh office has been made New Orleans district manager.

## Electric Jolting Machine

The molding machine as shown in the accompanying illustration, was developed and placed on the market by the American Foundry Equipment Co., New York. It is a self contained unit, the motor being mounted on part of the same base casting, as that which supports the train of gears and the operating mechanism. The base on which the jolting table is mounted is a separate casting; but when the machine is assembled the two base castings are bolted together firmly, making the base to all intents and purposes, a one piece casting.



TOGGLE JOINTED LIFTING ARMS ARE ATTACHED TO THE TABLE CORNERS

A sprocket pinion on one end of the motor shaft is connected by a suitable chain to a sprocket wheel provided with a friction clutch. By means of the long upright lever at the left of the illustration, the operator can control the action of the table to a nicety. A train of gears in the covered gear casing shown, serves to actuate a crank arm attached to a connecting rod which, by means of a suitable cam arrangement on the inside of the table base, imparts an oscillating movement to a central shaft connected at either end to a pair of toggle jointed arms which alternately raise and drop the table.

## Makes Asset of a Building Obstacle

(*Concluded from page* 201)

motor is stopped. A simple push-button enclosed switch is provided near the compressor unit so that the motor may be stopped instantly if desired, and further so that the automatic control feature may be thrown out over night or during periods when the plant is not operating.

Similarly the two blowers, which supply the air pressure for the old burners at all the furnaces are automatically controlled. A large tank is used as an equalizer, which maintains a constant pressure of 30 pounds. A Cutler-Hammer starter and cut out set similar to that used on the compressor line, operates each blower separately or both together as may be necessary depending upon the amount of air which is being used, and an automatic safety release valve prevents the pressure from rising above 35 pounds per square inch.

The electrical equipment throughout the plant is in keeping with that which has been mentioned. Realizing the essential character of uninterrupted service, Mr. Mueller has expended minute attention upon all important details. The transformer room, shown in Fig. 12 is indicative of this point. Ordinarily, transformers are mounted upon poles or housed in a shack without the plant, where the sleet and storm hazard is ever present, but at the Mueller foundry a separate fireproof room was built over the machine shop at one corner of the plant. In this room are grouped the three 100-kilovolt-ampere transformers which step down the current from 13,500 volts to 440 or 220 volts; a motor-generator set which converts the alternating to direct current for the lights and crane motors; and the switches and controller sets for the various units mentioned. This special room and the appurtenances, which might have been omitted had the usual system been followed, cost perhaps a third more, but undoubtedly will provide a greater life for the transformers and a greater security against interruption of service.

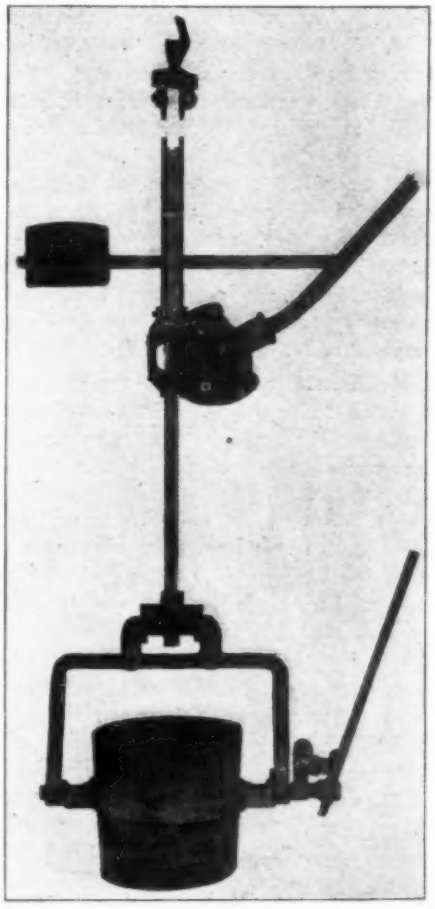
All the equipment in the finishing room is shaft driven from a single General electric motor. The cleaning equipment includes a sprue cutter made by the Tessmer Machine & Tool Co., Detroit; two sand-blast barrels supplied by the Macleod Co., Cincinnati, and provided with an exhaust fan system made by the Buffalo Forge Co., Buffalo; and six stand grinders including one made by the Norton Co., Worcester, Mass. and five furnished by the Safety Emery Wheel Co., Springfield, O.

## Joins Sales Force of Detroit Supply Company

Fred A. Herriott recently has joined the sales organization of The E. J. Woodison Co., Detroit. Mr. Herriott, who formerly was production manager of the foundry division of the American Blower Co., will make his headquarters at Grand Rapids, Mich., and will have charge of the western half of Michigan for the Woodison company.

## Devises Pouring Rig That Has Varied Uses

A pouring device with capacity up to half a ton, with exceptionally high lift, has been devised by the Modern Pouring Device Co., Port Washington, Wis. This device which is shown in the accompanying illustration con-



LEVER AND RACK LADLE LIFTING RIG

sists of a rack sliding in a cast steel frame, guided by two supporter rods. A gear meshing with the rack is revolved by a lever, and a regulating pin in the lever arm allows the ladle to be raised from two to eight inches at each stroke. This regulation makes it suitable for pouring stacked molds as it enables the operator to move the ladle the exact height to pour each row in the stack.

Three pawls, inside a friction brake drum hold the ladle at any desired height. By bearing down on the friction weight lever and relieving the brake hand, the operator can lower the ladle gradually or instantly to any position. The operator has a mechanical advantage of 12 to 1 and can lift up to 1000 pounds of metal. The bail yoke is swiveled at the bottom of the rack, a lock holding it in position. By raising the lock, the bail can be revolved a quarter turn, allowing pouring from in front of the machine as well as from the side. This device also may be used for rolling over, shaking out, picking off and transporting castings.

## Purchase Gordon Holdings

The Superior Sand Co., 503 Guardian building, Cleveland, purchased extensive holdings of molding sand from the Gordon Sand Co. These holdings are located at Canal Fulton, O., and are known as the Gem and Chrystal Springs deposits. The sand has been widely known for its exceptional adaptability to the production of light gray-iron, brass and aluminum castings. This acquisition makes the Superior company one of the largest molding sand companies in Ohio.

## Welding New Necks on Steel Mill Rolls

The accompanying illustrations show a successful method employed by Charles Forsberg for welding broken rolls at the plant of the Algoma Steel

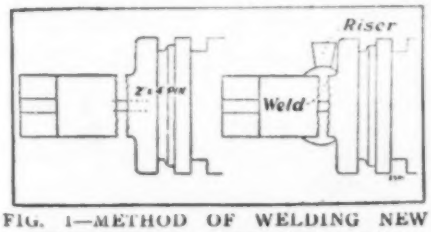



FIG. 1—METHOD OF WELDING NEW NECK AFTER A NEW END HAD BEEN CAST

Co., Sault Ste. Marie, Ont. A new casting for the neck and wabbler is made off a pattern prepared for that purpose. A short 2-inch pin, fitting in suitable holes drilled in the center of the new piece and the old casting is a handy factor in helping to line up the two parts. An opening approximately 2 inches, but varying of course according to the size of the roll, is left between the two parts to receive the welding material. The mold is prepared and poured according to the regular schedule for thermit welding.

Owing to the fact that certain strains are set up in cooling which are likely

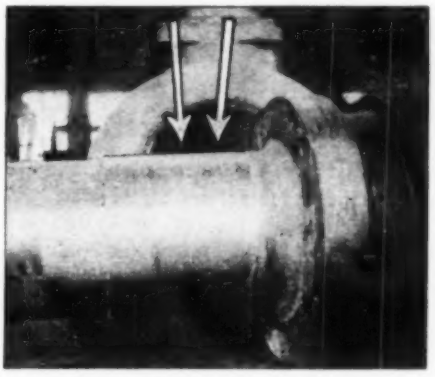
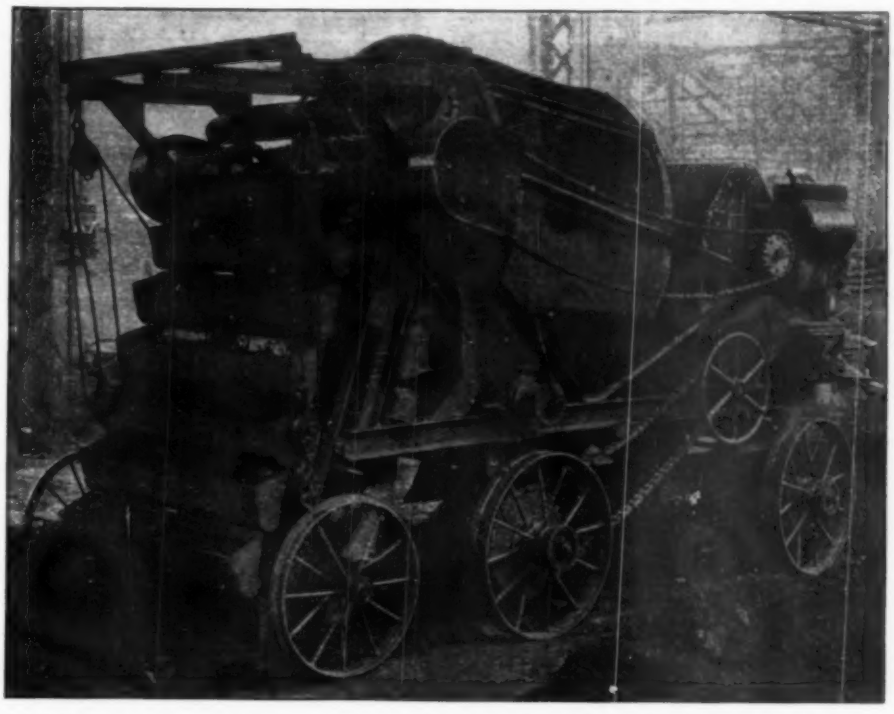


FIG. 2—APPEARANCE OF NEW NECK AFTER MACHINING

to distort and throw the pieces out of alignment the new neck is not machined until after it is welded to the roll. Railroad thermit is used for welding either iron or steel rolls. This comprises a mixture of iron oxide and aluminum, together with pure manganese, 1 per cent nickel shot, 5/8 per cent and mild steel punchings, 15 per cent.

## Machine Cuts Sand Heap and Riddles Sand

A machine developed by the Clement A. Hardy Co., Chicago, is shown in the accompanying illustration. This goes one step further than some machines designed for the same general purpose in that it riddles the entire sand heap in addition to cutting it over. A bucket elevator is mounted on the front of the machine to deliver the sand to a rotary screen which is designed to remove all the gaggers, nails scrap, etc., left in the sand each day after the castings have been shaken out. All foreign material is collected at the back of the screen and afterward dumped at the end of the floor. The screened sand falls between wide lateral grides which form it into a straight, even and uniform sand pile. It is claimed that the best results are obtained by running the machine over the sand pile twice, once before the sand has been wet down and once afterward.

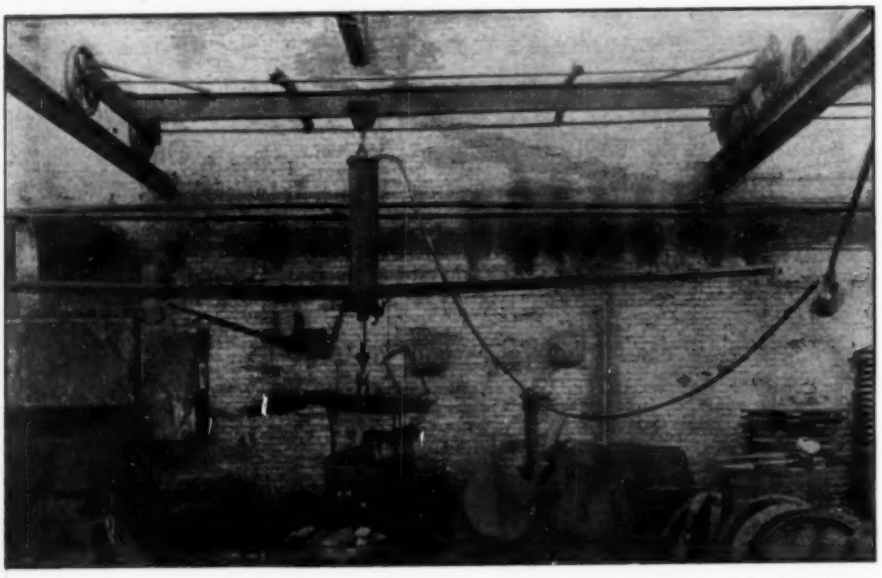


BUCKET ELEVATORS LIFT THE SAND TO THE RIDDLE FROM WHENCE IT DROPS TO THE CUTTING BLADES

The machine shown in the illustration is electrically driven and is equipped with two speeds. It can be propelled at a slow speed while passing through the sand heap and at a higher speed when traveling from one heap to another. A small gasoline engine may be substituted to furnish the power in the case of foundries which are not wired or connected with an electric power plant. The machine, is available for sale.

## Light Type Hand Crane

The hand power crane shown in the accompanying illustration has been developed by the New Jersey Foundry & Machine Co., 90 West Street, New York as an auxiliary to molding machine installations both for handling the molds and pouring the iron.



OWING TO ITS LONG WHEEL BASE AND LARGE WHEELS THE BRIDGE TRAVELS EASILY

The dimensions may be varied to to meet conditions; but the standard crane is made with trucks having a wheel base equal to about one third that of the bridge span. It is claimed that this feature eliminates almost entirely the friction and bind of the wheel flanges on the rails of the runway. The 21½-inch diameter wheels are fitted with Hyatt roller bearings which reduce the combined tractive friction to a minimum. It is said that one of these cranes with a 26-foot span and representing a total weight for crane and load of 5000 pounds can be moved by a pull of 40 pounds.

## Acquires Larger Sand Interests in Ohio

The Peerless Sand Co., Conneaut, O., has acquired the Gordon Sand Co. and the Ohio Sand Co. of that place and the added capacity of these two companies makes the Peerless Sand Co. one of the largest producers of molding sand in the United States. In March 1893 the late F. E. Gordon, a foundryman of wide experience, went to Conneaut to engage in the molding sand business and in 1897 he effected the organization of the Ohio Sand Co. In 1914 he organized the Gordon Sand Co. and until the time of his death the management of both of these companies was under his control. The Peerless Sand Co. was incorporated in 1918 by U. E. Kanavel, C. M. Bixler and F. L. Moore. Mr. Kanavel and Mr. Bixler had been associated with Mr. Gordon for a number of years. Mr. Kanavel whose experience in the sand business covers a period of several decades, was associated with the Ayers Mineral Co., Zanesville, O., and also the Interstate Sand Co., Cleveland. Mr. Bixler also at one time was affiliated with the Portage Silica Co., Youngstown, O. Mr. Moore formerly was affiliated with the Interstate Sand Co., Zanesville. The growth of the Peerless Sand Co. was rapid and molding sand pits were operated at Conneaut, Amboy, Kingsville, Sandusky and New Lexington, O., and Girard and West Springfield, Pa.

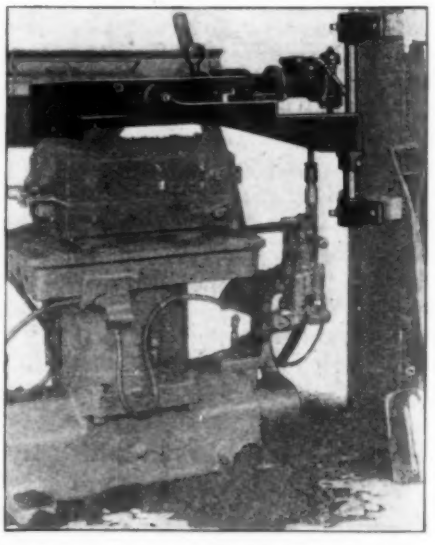
## War Conditions Affected Crucible Quality

In a recent case decided in Illinois, the quality of crucibles under war conditions was the point at issue. A foundry contested payment for the crucibles which it stated were of inferior quality, some even breaking and permitting the metal to run into the pit of the furnace. The crucible company pointed out, that by letter and circular it had advised of its inability to procure Ceylon graphite or German clay and as the American materials substituted were at that time the object of experimentation it could not be responsible for quality and therefore did not guarantee its product. The court ruled that the foundry had been made acquainted with the facts prior to purchasing the crucibles and therefore a judgment was entered in the amount of the manufacturers claim for the price.

## Swivel Post Shaker Has Advantages

A swivel-post shaker being introduced by the Hanna Engineering Co., Chicago, is shown in the accompanying illustration. It is especially designed for use in connection with molding machines. It swings on a vertical shaft held in brackets, fastened to a wall or post, and is furnished with an automatic valve which admits air to the cylinder for starting the shaker as it swings into place over the flask, and cuts off the air when the shaker is swung back out of the way. The latter operation is almost involuntary on the part of the molder.

The screen box is rectangular and is arranged so that screens of different dimensions can be used. The wire cloth is slipped into a space between angles and securely held in place by a cap screw and washer in front of the screen box, thus providing an easy means for changing the screen. The box can be dumped and cleared of the coarse material by lifting one end off the frame while the other end swings on two bolts. When in operation the loose



THE ACTUATING MECHANISM IS UNIT WITH THE RIDDLE SUPPORT

end of the box is held in place by a spring catch.

This type of shaker is convenient for applying facing sand, the screen box containing enough sand for several molds, thereby avoiding the fatigue of lifting the full riddle.

This swivel-post shaker is furnished with screen box either 9 x 12 inches or 12 x 14 inches. It can also be arranged to accommodate an 18-inch round riddle. All machines are 52 inches from face of post to center of flask.

# Inquiries Show Slight Improvement

## Varied Conditions Govern in Different Sections of the Country with Better Prospects for Equipment Sales Noted in the Eastern States

FEBRUARY has brought forward little of definite promise for the future in foundry equipment demand. Inquiries have improved both in volume and character, and foundry supply sales have increased, but definite orders for molding, melting, handling and finishing machinery have been few. A slightly better prospect exists in the East, where foundry operations have picked up and signs of recovery are noted. Cost considerations under the present keen competitive conditions among foundries are leading many to investigate labor saving machinery, who have not at present the means to fill their needs. Business revival will serve to materialize inquiries of this class which at present are vague. One of the characteristics of the situation is that the small manufacturer is the one placing the majority of the orders and making the inquiries, the large concerns apparently being out of the market. Automobile foundries are not active in the market and it is thought they will do little buying this year. Plumbing supply houses are preparing for more business and are ordering equipment which would seem to indicate signs of a revival in the building trade. Few orders are being placed which amount to more than $1000 although one molding machine company sold a $7000 rollover, jolt machine.

One firm sold oven equipment for two new and one old foundry and to one firm which is making additions to its plant. Smith's Falls Malleable Castings, Ltd., Smith Falls, Ont., Can., is contemplating doubling its No. 2 plant and has made provision in its charter for the manufacture of steel castings. It will also install an up-to-date machine shop. Indications of past business were shown in a shipment recently of 18 car loads of cranes and open-hearth charging machines made by the Alliance Machine Co., to Balboa, Spain.

### *Eastern Market Varied*

WHILE demand for foundry equipment in the East is spotty and of rather small order, there is an improvement. Sellers report that this is especially true with regard to flasks and sundry supplies, indicating at least an increase in operations. However, buying of the larger equipment is lacking, there being but few scattered orders reported. The Ramapo Foundry and Wheel Works, Ramapo, N. Y., recently purchased a cupola from the Whiting Corp., Harvey, Ill., and the Lunkenheimer Co., Cincinnati, placed about $2500 worth of sand blast machinery.

The Standard Oil Co. of New Jersey, 26 Broadway, New York, which has been figuring for some time on about $15,000 worth of equipment for its proposed foundry in Roumania, is expected to close soon. Special interest is being shown in the placing of this order, as it has been persistently reported that German manufacturers are making a strong bid for the business.

Another proposition likely to become active shortly is that of the White Fuel Oil Engineering Corp., 742 East Twelfth street, New York City. Within the past week, this company has brought out several small inquiries. It is estimated that it will require approximately $20,000 worth of equipment, in addition to two electric cranes of 20 and 10 tons capacity, respectively; both to have a span of 50 feet.

Some foundry equipment it is expected will be purchased by the Union Tank Car Line Co., 21 East Fortieth street, New York City, for a $3,000,000 plant in Lima, O. All machinery is to be purchased through the New York offices, and some inquiries are being issued at this time, although it is understood they are principally for estimating purposes. Leading manufacturers of motors have reduced prices 10 per cent. The Taunton Castings Co., Taunton, Mass. has been incorporated with a capital stock of $25,000, and later expects to build a new foundry. Morton McI. Dukehart & Co., Baltimore, manufacturers of power plant equipment, are making arrangements to erect a small foundry to handle their own work and some jobbing orders in gray iron.

### *Little Replacement Inquiry*

FOUNDRIES in the Pittsburgh district are not taking any marked advantage of the present industrial lull to make installations of foundry equipment. For the most part these have equipment which is more than adequate for their present restricted operations. Spasmodic sales of sand mixers, core ovens, ladles, etc., are reported and inquiries are fairly frequent. One recent order received by the Herman Pneumatic Machine Co., came from the International Harvester Co., for its Milwaukee plant, covering two 40 x 124-inch stripping plate machines and a 24 x 40-inch rollover machine. Companies recently issuing inquiries for molding machine include the Union Steel Castings Co., Pittsburgh, the Oil Well Supply Co., Oil City, Pa., and the Ajax Foundry Co., Corry, Pa. The Bessemer Gas Engine Co., Grove City, Pa., is a prospective purchaser of foundry equipment. While a number of inquiries are out from foundries for crane equipment, considerable backwardness to place orders is noted. Users anticipate price reductions and while so far no concessions have been offered by the crane builders, they are not getting the business at present levels. The Standard Sanitary Mfg. Co., Pittsburgh recently has purchased two parcels of ground aggregating 80,000 square feet to take care of future expansion.

### *Chicago District Remains Quiet*

ENGINEERS in the West find little tendency to put up new plants, but some remodeling is being done, owners taking advantage of the slack situation to make changes and a little business in equipment results from this. One house has received a few inquiries for small hand power and I-beam cranes, but the inquiries as a rule have not resulted in sales. The Joliet Steel & Iron Co., Joliet, Ill., is building an addition 75 x 160 feet and making improvements in its old foundry. The National Tank & Steel Co., East St. Louis, Ill., is having plans made for a 1-story foundry. The Zenith Foundry Co., Detroit, Mich., is building a foundry 90 x 200 feet. The Sioux City Foundry & Boiler Co., Sioux City, Iowa, has taken over the plant of the Foundry & Manufacturing Co., which it will re-equip and operate.

# What the Foundries Are Doing

## Activities of the Iron, Steel and Brass Shops

The capital stock of the Buffalo Co-Operative Stove Co., Buffalo, recently was increased from $75,000 to 325,000.

The capital stock of the Victor Aluminum Co., Wellsville, N. Y., recently was increased from $150,000 to $300,000.

The White Fuel Oil Engineering Co., New York, plans the erection of a foundry building, 2-stories, 99 x 103 feet.

The Chapman Valve Mfg. Co., Springfield, Mass., plans a foundry building, 27 x 50 feet.

The Trumbull Bronze Co., Warren, O., has started operations in its new foundry, which is 40 x 120 feet.

The foundry of Hirsch Bros., Milwaukee, manufacturer of agricultural implements, recently was damaged by fire.

The Zenith Foundry Co., Miller avenue, Detroit, is building a foundry building, 90 x 200 feet.

The plant of the Fowler Foundry Co., Bradford, Pa., recently was damaged by fire.

The Randolph Foundry Co., Randolph, Mass., is erecting a foundry building, 50 x 75 feet.

E. R. Caldwell & Co., Bradford, Pa., has postponed indefinitely erection of a foundry addition, which it has been planning for some time.

Arthur Harris & Co., 212 North Curtiss street, Chicago, copper and brass founder, plans the erection of a new plant building, 51 x 52 feet.

The Fulton Smelting & Refining Works, Brooklyn, N. Y., recently incorporated with a capital stock of $25,000, by E. Aron A. Sebring and A. Keller, 604 Sixth street.

Waldron & Van Winckle, 27 Wall street, New York, are preparing plans for the erection of a foundry, 115 x 252 feet, for the Windsor Foundry Co., Windsor, Vt.

The Sterling Steel Foundry Co., Bradford, Pa., is reported planning to rebuild its plant building which was recently damaged by fire.

The Southern Michigan Brass Foundry Co., Hudson City, Mich., has been incorporated with a capital stock of $5000, to manufacture brass, aluminum and bronze castings.

Capitalized at $10,000, the Cast Products Co., Cleveland, recently was incorporated by E. N. Corlett, A. G. Borchert, E. R. Janston, S. M. Corlett and H. C. Janston.

The A. F. Thompson Co., Huntington, W. Va., manufacturer of stoves, etc., has acquired the plant of the Climax Rubber Co., which it will use as a plant.

Plans are under way for rebuilding the plant of the R. P. Power Foundry Co., Worcester, Mass., which was recently damaged by fire.

The building housing the flange department of the Dayton Malleable Iron Co., Dayton, O., recently was damaged by fire. It is stated the building will be replaced.

Robert H. Gaylord, 1814 Virginia road, Los Angeles, has organized the Gaylord Foundry Co., which will establish a plant at 2601 East Twenty-sixth street, Los Angeles.

The Lockport Deoxidized Bronze & Metal Co., has been incorporated with a capital stock of $30,000 with offices at Lockport, N. Y., by J. C. Rock, P. K. Haber and J. Zaluski.

The McMyler Interstate Co., Bedford, O., has sold its Warren, O., foundry to the Eastern Ohio Mfg. Co., which was recently organized. It will specialize in the manufacture of gray iron castings.

Rockport, McIntyre, Inc., Boston, has been incorporated to make agricultural implements, with a capital stock of $50,000, by Wendell D. Rockwood, and M. M. Dunn, of Cambridge, Mass., and J. W. McIntyre.

The Imperial Japanning & Enameling Works, Inc., 408 West Grand avenue, Chicago, has been incorporated with a capital stock of $100,000, by Joseph V. Janda, A. Skailand, William Link and others.

The Waters Arc Welding Corp., New York, recently was incorporated with a capital stock of $100,000, by F. C. Lord, H. A. Miller and A. K. George, 166 West Seventy-seventh street.

The W. N. Best Furnace & Burner Corp., New York, recently was incorporated with a capital stock of $1,000,000, by M. Rogers, B. J. Sykes and W. H. Gillon, 1246 Pacific street.

The Seabring Copper Works, Brooklyn, N. Y., has been incorporated with a capital stock of $25,000, by R. J. Fleissner, J. D. Maxwell and F. V. Smith, 97 Clark street, and others.

The Woburn Brass & Iron Foundry, Inc., Woburn, Mass., has been incorporated with a capital stock of $75,000 by Daniel P. O'Brien, Thomas H. Marriman and George H. Foley.

The Pennsylvania Mold & Iron Co., Pittsburgh, is being organized by W. P. Dietz, George H. Lewis, and James K. Fawcett. The company is represented by Sterrett & Acheson, 1927 Oliver building, Pittsburgh.

Capitaized at $50,000, the American Mfg. Co., Reading, Pa., has been incorporated by Henry T. Shick, John A. Whitman and others, to engage in the manufacture of brass, bronze and other metal products.

The Connecticut Iron & Metal Co., Bridgeport, Conn., has been incorporated with a capital stock of $50,000, by Samuel Carp, A. Rachelson, Harry Danberg, and others, to refine and smelt metals, etc.

The Toronto Furnace Co., Ltd., Toronto, Ont., has been incorporated to manufacture furnaces, stoves, heaters, etc., with a capital stock of $200,000, by Charles H. Bowyer, Henri G. Smith and a number of others.

Capitalization of the Schlangen Bros. Co., Chicago, manufacturer of brass goods, recently was increased from $50,000 to $100,000. The following officers have been elected. President N. A. Schlangen; treasurer, Carl Schlangen and secretary, E. C. Roos.

The A. W. Cash Co., Ltd., Toronto, Ont., has been incorporated to manufacturer iron, steel, metal forgings, castings, etc., with a capital stock of $50,000, by James L. Ross, Arthur W. Holmested, Arthur B. Mortimer and others.

The Siche Gas Range & Heater Co., Ltd., Toronto, Ont., has been incorporated to manufacture heaters, ranges, stoves, boilers, etc., with a capital stock of $60,000, by Frank J. Hughes, Leo J. Phelan, Daniel P. J. Kelly and others, all of Toronto.

The Christensen & Olsen Foundry Co., 1713 Carroll avenue, Chicago, recently was incorporated to manufacture castings of brass, bronze, and aluminum, with a capital stock of $5000. The incorportors are Arthur O. Olsen, S. L. Christensen and Albert Christensen.

The Turner Brass Works, Sycamore, Ill., has been sold by Charles C. Reckett to S. L. Maytag and others, connected with the Maytag Washing Machine Co., Newton, Iowa. It is said the plant will be utilized for the manufacture of electric motors.

The Hagar-Mann Mfg. Co., Boston, has been incorporated with a capital stock of $500,000 to make motors, etc., by Franklin D. Hagar and Gordon J. Langell, both of Somerville, Mass., Orrin W. Mann, Arthur B. Corey and William F. Brock, both of Rockland, Mass.

Established in 1878 by William H. Frost and Charles Jones, with a capital stock of $2500, the Smith's Falls Malleable Castings Co., Ltd., Smith's Falls, Ont., recently was reincorporated as the Smith's Falls Malleable Castings, Ltd., with an authorized capital stock of $750,000.

The Twin Ports Steel & Tractor Co., Superior, Wis., organized several months ago, has acquired the interests of the Evered Foundry & Machine Co. of the same city. The manufacture of gas tractors, hoisting engines and power winches, will be continued and in addition several new lines will be added. A jobbing department will also be established for pattern, casting and machine work.

Advices have been received from the Taunton Castings Co., Taunton, Mass., to the effect it has been incorporated with a capital stock of $25,000. It expects later on to build a new foundry building, but at present it is occupying the Tremont street plant of the White-Warner Co. Officers of the company are: President, J. P. McKenna; general manager, Elmar Owran and secretary, Wilbur E. Forbes.

The Valley Iron Works, Appleton, Wis., operating a foundry and machine shop specializing in the manufacture of paper mill machinery, has been acquired by a group of local capital headed by Ernest Mahler, E. A. Peterson and others. The principal product of the plant is a paper mill beater. The new ownership is figuring upon the construction of a new plant as soon as conditions become more favorable than they are at present.

The Koehring Co., Milwaukee, filed articles of incorporation recently. It represents the development of the business of the Koehring Machine Co., manufacturer of concrete mixers and similar equipment. The new corporation has a capital stock consisting of 25,000 shares of preferred stock of a par value of $100 each, and 25,000 shares of common stock without par value. The incorporators are: Philip A. Koehring, A. W. Erwin and William J. Zimmers.